

Overview

Overview of iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)

For full technical specifications, refer to Apple Support Tech Specs: support.apple.com/specs/imac.



Serial Number Location

The serial number for the following iMac models is located on the bottom of the stand.

Note: If the computer has a VESA mount, then the serial number is located on the underside of the VESA mount tongue. The VESA mount for iMac Pro (2017) is customer installable.

- iMac (21.5-inch, Late 2012)
- iMac (27-inch, Late 2012)
- iMac (21.5-inch, Early 2013)
- iMac (21.5-inch, Late 2013)
- iMac (27-inch, Late 2013)
- iMac (21.5-inch, Mid 2014)
- iMac (Retina 5K, 27-inch, Late 2014)
- iMac (Retina 5K, 27-inch, Mid 2015)
- iMac (21.5-inch, Late 2015)
- iMac (Retina 4K, 21.5-inch, Late 2015)
- iMac (Retina 5K, 27-inch, Late 2015)
- iMac (21.5-inch, 2017)
- iMac (Retina 4K, 21.5-inch, 2017)
- iMac (Retina 5K, 27-inch, 2017)
- iMac Pro (2017)

When replacing the stand, use a fine-tip black permanent marker to neatly write the serial number on the bottom of the new stand.

Note: If replacing the VESA mount, then write the serial number on the underside of the replacement VESA mount tongue.



Input Devices

Magic Trackpad 2



Magic Mouse 2



Magic Keyboard



Magic Keyboard with Numeric Keypad



- Pairs via Bluetooth or via Lightning connector
- Embedded battery
- On/off switch
- Lightning connector
- Can be used wired or wireless (keyboards)

On/Off Switch

To turn on the Magic Trackpad or Magic Keyboards, use the on/off switch (see 1 below) on the back of the device. This switch is located on the bottom of the device for Magic Mouse 2. If green is visible inside the switch, then the device is turned on. There is no indicator light. **Note:** When Magic Keyboards are turned on and paired with a system, the Caps Lock LED will light up when Caps Lock is active.

Lightning Connector

The devices can be used wirelessly or wired, by plugging into the Lightning connector (see 2 below).

Magic Trackpad 2 (back)



Magic Keyboard (back)



Magic Keyboard with Numeric Keypad (back)



Magic Mouse 2 (bottom)



Pair the device:

- The device will automatically pair when plugged in. Plug the device into a USB port on the computer and it will be detected.
- The device can also be paired wirelessly. Turn the device on, find the name in the Bluetooth preference pane, and click the name to pair.

Note: To check if the device is turned on, go to System Preferences > Bluetooth or click the Bluetooth icon in the menu bar. If the device is both turned on and paired with the computer, then it will show in bold.

Charge the device:

- Plug the device into a USB port on the computer using the Lightning cable.
- Plug the device into a 5W, 10W, or 12W Apple USB Power Adapter using the Lightning cable.

Note: The computer will show an alert when the battery is low. The battery level information can also be found by selecting the device in the Bluetooth menu in the menu bar.

General Troubleshooting

Update Software and Firmware

Important: Before troubleshooting, ensure the correct version of macOS is installed, and check for and apply the latest software and firmware updates. Computers sometimes exhibit symptoms that indicate the incorrect version of macOS is installed. Refer to [HT201686: Use the Mac operating system that came with your Mac, or a compatible newer version](#) to make sure system build is correct for this computer model.

Firmware refers to software that is written into memory circuits such as flash memory, which will hold the software code indefinitely, even when power is removed from the hardware. Firmware on Intel-based Mac computers prior to computers with an Apple T2 Security Chip is designed to be updated if necessary by running macOS Software Update (available in the Apple () menu under About This Mac) while the computer is connected to the Internet.

For computers with an Apple T2 Security Chip, SMC and EFI separate firmware images have now both been integrated into bridgeOS.

Troubleshooting Techniques

For more information, go to [ATLAS](#) and enter “troubleshooting” in the search field.

Hardware versus Software

To isolate a hardware issue from a software issue, refer to [HT203161: Isolating issues in macOS](#).

To troubleshoot a software issue, refer to the following articles:

- [HT201516: How to troubleshoot a software issue](#)
- [HT201861: About incompatible software on your Mac](#)
- [HT204323: If a flashing question mark appears when you start your Mac](#)
- [HT204904: How to reinstall macOS from macOS Recovery](#)
- [HT202574: About Fusion Drive, a storage option for some Mac computers](#)

Power-On Self-Test (POST)

Intel-based Mac computers such as the iMac rely on a combination of tones and blinking LED lights to display Power-On Self-Test (POST) error codes.

- If the computer detects out-of-specification or no Random-Access Memory (RAM), the screen will remain black but the computer will beep. This error condition may be due to physically damaged RAM, installing an incorrect type of RAM, or not having RAM installed.
- Some RAM may appear to pass POST, but still cannot be used by the operating system. In this case, the computer will display a gray screen, sound three beeps and repeat beeps until computer is turned off.
- The solution to both of these situations is to first reseal RAM and test computer again. If RAM fails POST again, remove all installed RAM and test by installing one by one each RAM module that has been verified to work correctly on another computer ("known-good" RAM, for example) or order new RAM.
- A sequence of tones heard at startup or a no video symptom may also be fixed by temporarily removing/replacing the backup battery.

For more information, refer to articles:

- [HT202768: About Mac startup tones](#)
- [HT201702: About Mac Power On Self Test \(POST\) RAM error codes](#)
- [HT201255: Startup key combinations for Mac](#)

Quick Check Procedures

System Configuration for Macs with the Apple T2 Security Chip

Important: For Macs with the Apple T2 Security Chip, the repair process is not complete for certain parts replacements until the AST 2 System Configuration suite has been run. Failure to perform this step will result in an inoperative system and an incomplete repair.

- [TP1657: System Configuration for Macs with the Apple T2 Security Chip](#)
 - For MacBook Pro (2018): Display assembly, logic board, top case, and Touch ID board
 - For MacBook Air (Retina, 13-inch, 2018): Logic board and Touch ID board
 - For iMac Pro: Logic board and flash storage
 - For Mac mini (2018): Logic board

Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. On some Mac computers, the Apple T2 Security Chip integrates several controllers—such as the SMC, image signal processor, audio controller, and SSD controller. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting the SMC may resolve it.

For more information and instructions to reset the SMC on different computer models, refer to [HT201295: How to reset the System Management Controller \(SMC\) on your Mac](#).

Note for iMac: If the power button is pressed while the power cord is being inserted, the iMac will enter a mode that runs the fans at full speed. For more information, refer to [HT204463: iMac: Fans run at full speed after computer turns on](#).

Note for iMac Pro (2017): If the power button is pressed while the power cord is being inserted, the iMac will enter Device Firmware Upgrade (DFU) mode and will need to be restored.

Resetting Nonvolatile RAM (NVRAM)

NVRAM stores certain system and device settings in a location that macOS can access quickly. Exactly which settings are stored in the computer's NVRAM varies depending on the type of computer, connected devices, and drives. To reset NVRAM:

For information, refer to [HT204063: How to Reset NVRAM or PRAM on your Mac](#).

Starting Up in Safe Mode

Safe mode (sometimes called safe boot) is a way to start up a Mac so that it performs certain checks and prevents some software from automatically loading or opening. These changes can help resolve or isolate certain issues on the startup disk.

For information, refer to [HT201262: Use safe mode to isolate issues with your Mac](#).

Recovering a Lost Firmware Password

Only technicians at Apple Stores or Apple Authorized Service Providers can unlock the following Mac models when they are protected by a firmware password:

- iMac (Mid 2011) and later
- iMac Pro (2017)
- MacBook (Retina, 12-inch, Early 2015) and later
- MacBook Air (Late 2010) and later
- MacBook Pro (Early 2011) and later
- Mac mini (Mid 2011) and later
- Mac Pro (Late 2013)

Refer to the technician instructions in [HT204455: How to set a firmware password on your Mac](#).

Diagnostic LEDs and Test Pads

Diagnostic LEDs and Test Pads for iMac (Retina 5K, 27-inch, 2017)



Warning: HIGH VOLTAGE. Be extremely careful when working inside the computer while power is applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Be very careful not to touch tools to logic board components other than the test pads.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

Refer to the following articles for more information:

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch\): Safety](#)

The iMac (Retina 5K, 27-inch, 2017) model has five diagnostic LEDs and two pairs of test pads that can help you troubleshoot the computer without removing the logic board.

The coin battery, located on the back of the logic board, provides power to the real-time clock (RTC) and parameter RAM (PRAM) when the computer is not connected to an AC power source. The RTC maintains the date and time, while the PRAM stores information such as speaker volume, screen resolution, startup disk selection, and recent kernel panics. The coin battery is designed to last several years and does not normally require replacement. However, if there are issues with the functions listed above, the RTC and PRAM may need to be reset or the coin battery may need to be replaced.

A. Diagnostic LEDs

- See the full description of LED behaviors below the locator image.

B. Coin Battery Voltage Test Pads

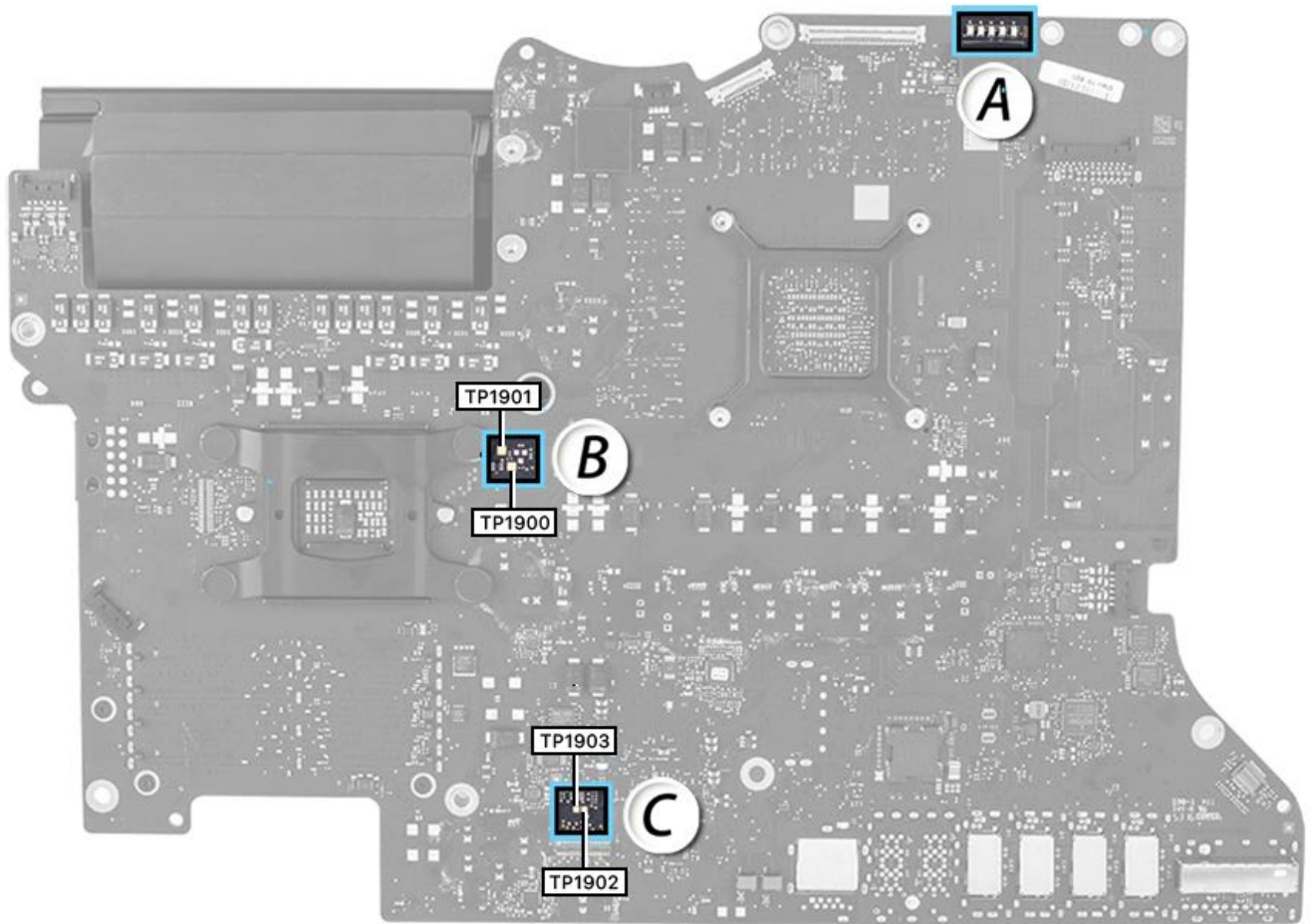
- Shut down and unplug the iMac. Allow approximately two minutes for the power supply to discharge.
- Measure the coin battery voltage by using a voltmeter set for DC. Place the probes on the pads. TP1901 = – (negative, same as chassis ground), TP1900 = + (positive) in location B, shown below. If the voltage is 2.7 volts DC or less, then the coin battery should be replaced.

C. Real-Time Clock (RTC) Reset Pads

- Shut down and unplug the iMac. Allow approximately two minutes for the power supply to discharge.
- Reset the RTC by shorting the pads in location C, shown below. Use the tip of a flat-blade screwdriver to touch both pads at the same time.

Caution: Do not make contact with any of the surrounding components or traces while performing this procedure. Some of the smaller components can be broken off very easily. Physically damaged boards warrant a logic board replacement.

iMac (Retina 5K, 27-inch, 2017) LEDs and Test Pads



Diagnostic LEDs (A)

LED 1

- Indicates that the trickle voltage from the power supply has been detected by the main logic board. This LED will turn on when you connect the iMac to a working AC power source. The LED will remain on as long as the computer is on or asleep.
- When the computer has been shut down correctly, LED 1 behavior may differ:
 - If a startup event is scheduled in System Preferences/Energy Saver, then LED 1 will stay on after a correct shutdown.
 - If no startup event is scheduled in System Preferences/Energy Saver, then LED 1 will turn off and will stay off as long as the power cord is kept connected and an AC power source is present. Disconnecting the power cord and plugging it back in will turn this LED back on, even if the computer is still off.
- After disconnecting and reconnecting the AC power source, this LED could remain off:
 - If the AC power source is missing or disconnected.
 - If the logic board is disconnected from the power supply or the AC receptacle.
 - If the power supply board is faulty.

LED 2

- Indicates that the computer is turned on. This LED will be on as long as the computer is turned on (but is not asleep) and the power supply and voltage regulators are working correctly.

LED 3

- Indicates that the logic board and GPU are communicating. This LED will be on when the CPU is communicating properly with the GPU. If LEDs 1 and 2 are on and LED 3 is off, then the backup battery (on the back of the logic board) may need to be reseated or the logic board may need replacement.

LED 4

- Indicates that the logic board and LCD panel are communicating. This LED will be on when the computer is turned on and a video signal is being generated. If LED 4 is on and there is no image on the display, then the LCD panel or the cables between the LCD and logic board might be installed incorrectly or need replacement.

LED 5

- Indicates the logic board and LCD panel are communicating. This LED is on when the computer is turned on, a video signal is being generated, and the LCD Panel is signaling to turn on the backlight. If LED 5 is ON and there is no image on the display, then the LCD backlight or circuitry on the logic board may be malfunctioning. The LCD panel or the cables or the logic board may need replacement.

LED Startup Sequence

LED 1 = Power is available.

If no LED is visible:

- Disconnect the power cord from the computer and wait 15 seconds to reset the power supply and LED status. Reconnect the power cord and check the LED status again.
- Verify the AC source.
- Verify that a known-good power cord is connected.
- Verify the cable connection between the AC inlet and the power supply.
- Verify the cable connection between the power supply and the logic board.
- Verify the power supply.

LED 1 + LED 2 = Power is available and the system is turned on.

If the second LED is not visible when the power button is pressed:

- Verify that the power button is connected to the power supply.
- Verify power button functionality.
- Verify the cable connection between the power supply and the logic board.
- Verify the power supply.
- Verify the logic board.

LED 1 + LED 2 + LED 3 = Power is available, the system is turned on, and the GPU was found.

If the third LED is not visible after the system is turned on:

- Verify whether the fan is running when turned on (reset SMC and PRAM, verify backup battery voltage for proper startup).
 - If the fan is not heard, go to the “No Startup” troubleshooting flow.

LED 1 + LED 2 + LED 3 + LED 4 = Power is available, the system is turned on, the logic board is communicating with the GPU, and the internal LCD was found.

If the fourth LED is not visible after the system is turned on:

- Verify the internal DisplayPort cable (eDP) connections between the LCD panel and the logic board.
- Inspect the LCD display cables for cable damage.
- Verify external video functionality and proceed according to the result:
 - If an external display works, verify/replace the LCD panel.
 - If an external display does not work, verify/replace the logic board.

LED 1 + LED 2 + LED 3 + LED 4 + LED 5 = Power is available, system is turned on, GPU is working, logic board is communicating with the LCD panel, and the LCD panel has turned on the LCD backlight.

If the fifth LED is not visible after the computer is turned on:

- Verify the internal DisplayPort cable and backlight cable connections between the LCD panel and the logic board.
- Inspect the LCD display cables for cable damage.
- Using a flashlight, check the following areas on the panel:
 - Look in the top left corner of the panel to see if there is a dim Apple logo (the Apple menu logo).
 - Look in the center of the panel to see if there is a login screen.
 - Look at the bottom of the panel to see if there is a Dock visible.
 - If the following items are visible, there may be something wrong with the display cables or the logic board. Proceed to the next step.
- Replace the LCD panel, check that all the LEDs are visible, and that the backlight functions. If the computer does not function after replacing the LCD panel, replace the logic board.

Diagnostic Software

Diagnostic Software for iMac (Retina 5K, 27-inch, 2017)

Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system to help technicians triage and verify repairs for Mac computers, starting with Mid 2014 models, except for MacBook Pro (Retina, Mid 2014). With AST 2, technicians are able to initiate diagnostics wirelessly on a user's device using Diagnostic Console (a web application on a Mac or iPad). Technicians are also able to view diagnostic results in Diagnostic Console.

For more information, refer to the following articles:

- [OP476: Latest Apple Service Toolkit download links and documentation](#)
- [TP1105: AST 2 for Mac Reference Guide - Table of Contents](#)
- [TP1118: AST 2 for Mac Reference Guide - Table of Contents \(Retail\)](#)
- [HT202731: How to use Apple Diagnostics on your Mac](#)

Thermal Sensors

SMC Name	Location	General Description (Degrees C)	Repair Suggestion
TA0p	Logic board top / back side, lower right edge	MLB ambient temperature	Excessive ambient temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tb0p	Logic board bottom / front side, center right	Backlight Controller proximity temperature	Excessive backlight controller temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TC0p	Logic board top / back side, upper right edge	CPU proximity temperature	Excessive CPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TG0d	Logic board top / back side, on large GPU IC	GPU die temperature	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG1d	Logic board top / back side, on large GPU IC	GPU die temperature	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG0p	Logic board bottom / front side, center right	GPU proximity temperature	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG1p	Logic board top / back side, upper center edge	GPU VRAM proximity temperature	Excessive GPU VRAM temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG2p	Logic board top / back side, center left	GPU VRAM proximity temperature	Excessive GPU VRAM temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TL0p	LCD panel, back	Display temperature	Excessive display temperature or sensor is damaged or disconnected from SMC. Check logic board and display connectors and fan operation.
TL1p	LCD panel, back	TCON temperature	Excessive display temperature or sensor is damaged or disconnected from SMC. Check logic board and display connectors and fan operation.
TM0p	Logic board top / back side, near left side of top SO-DIMM sockets	DIMM proximity 0 temperature	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM1p	Logic board top / back side, near right side of bottom SO-DIMM sockets	DIMM proximity 1 temperature	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM2p	Logic board top / back side, near right side of top SO-DIMM sockets	DIMM proximity 2 temperature	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM3p	Logic board top / back side, near left side of bottom SO-DIMM sockets	DIMM proximity 3 temperature	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
Tm0p	Logic board top / back side, center right edge	MLB proximity 0 temperature	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm1p	Logic board bottom / front side, above USB-C ports	MLB proximity 1 temperature	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm2p	Logic board top / back side, under CPU	MLB proximity 2 temperature	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm3p	Logic board top / back side, center right edge	MLB proximity 0 temperature	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tp2h	Inside power supply	PSU T2 secondary heat sink temperature	Excessive power supply temperature or sensor is damaged or disconnected from SMC. Check power supply connectors and fan operation.

Electrical Sensor Table

SMC Name	Location	General Description	Units	Repair Suggestion
VC0C	Logic board	CPU Core load-side	Volts	Out of range CPU voltage was found or open signal to SMC. Check logic board connectors.
VC0G	Logic board	CPU Core GT+GTX	Volts	Out of range CPU voltage was found or open signal to SMC Check logic board connectors.
VC0I	Logic board	CPU VCCIO	Volts	Out of range CPU voltage was found or open signal to SMC Check logic board connectors.
VC0M	Logic board	3.3V S5 load-side	Volts	Out of range CPU voltage was found or open signal to SMC Check logic board connectors.
VC0S	Logic board	CPU VCCSA	Volts	Out of range CPU voltage was found or open signal to SMC Check logic board connectors.
VD2R	Logic board	Power Supply 12V	Volts	Out of range power supply voltage. Check power supply connections to the logic board.
VG0C	Logic board	GPU Core Alt	Volts	Out of range CPU voltage was found or open signal to SMC. Check logic board connectors.
VG0I	Logic board	GPU VDDCI	Volts	Out of range GPU voltage was found or open signal to SMC. Check logic board connectors.
VG1A	Logic board	GPU Highside	Volts	Out of range GPU voltage was found or open signal to SMC. Check logic board connectors.
VG1C	Logic board	GPU Core 12V regulator	Volts	Out of range GPU voltage was found or open signal to SMC. Check logic board connectors.
VG1F	Logic board	GPU Frame Buffer 1.5V	Volts	Out of range GPU voltage was found or open signal to SMC. Check logic board connectors.
VH02	Logic board	HDD 12V	Volts	Out of range HDD voltage was found or open signal to SMC. Check logic board connectors.
VH05	Logic board	HDD 5V	Volts	Out of range HDD voltage was found or open signal to SMC. Check logic board connectors.
VM0R	Logic board	CPU + DIMM 1.2V	Volts	Out of range CPU or memory voltage was found or open signal to SMC. Check logic board connectors.
VR1R	Logic board	3.3V S4 load-side	Volts	Out of range CPU or memory voltage was found or open signal to SMC. Check logic board connectors.
IC0C	Logic board	CPU IA Core (IMON)	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC0G	Logic board	CPU Core GT+GTX (IMON)	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IC0I	Logic board	CPU VCCIO	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC0M	Logic board	CPU + DIMM 1.2V	Amperes	Out of range CPU or memory current was found or open signal to SMC. Check logic board connectors.
IC0S	Logic board	CPU VCCSA (IMON)	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC35	Logic board	3.3V S5 load-side	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC54	Logic board	5V S4 load-side	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
ID2R	Logic board	Power Supply 12V	Amperes	Out of range power supply current. Check power supply connections to the logic board.
IG0C	Logic board	GPU Core alt	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG0I	Logic board	GPU VDDCI	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG1A	Logic board	GPU High	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG1C	Logic board	GPU Core 12V regulator	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG1F	Logic board	GPU Frame Buffer 1.5V	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IH02	Logic board	HDD 12V	Amperes	Out of range HDD current was found or open signal to SMC. Check logic board connectors.
IH05	Logic board	HDD 5V	Amperes	Out of range HDD current was found or open signal to SMC. Check logic board connectors.

IH1R	Logic board	3.3V S4 load-side (SSD)	Amperes	Out of range flash storage current found or open signal to SMC. Check logic board and flash storage connectors.
IM0R	Logic board	CPU + DIMM 1.2V	Amperes	Out of range CPU or memory current was found or open signal to SMC. Check logic board and memory connectors.
IR35	Logic board	System 3.3V	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IR54	Logic board	System 5V	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.

Testing the Panel Using the Display Extension Cable Kit

Testing the Panel Using the Display Extension Cable Kit for iMac (27-inch, Late 2012–2017) and iMac Pro (2017)

Use the display extension cable kit to:

- Test the system and/or panel before securing the panel to the very high bond (VHB) adhesive strips.
- Test the functionality of the panel's Embedded DisplayPort (eDP) cable.



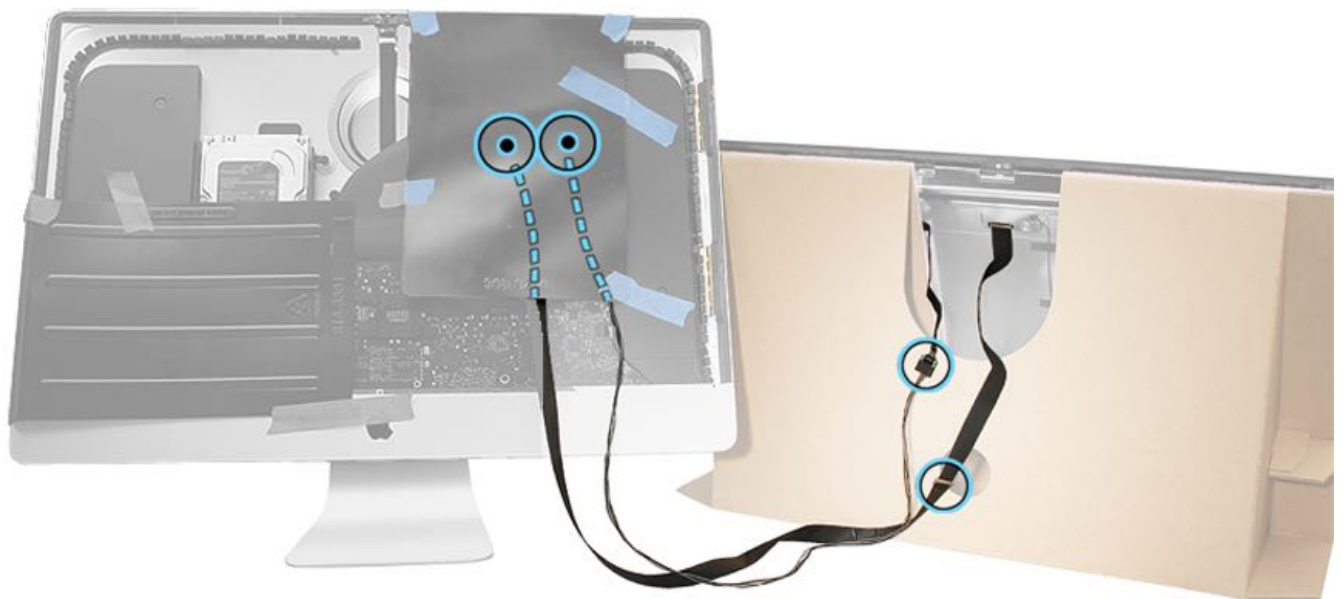
Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or the power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Refer to the following articles for more safety information:

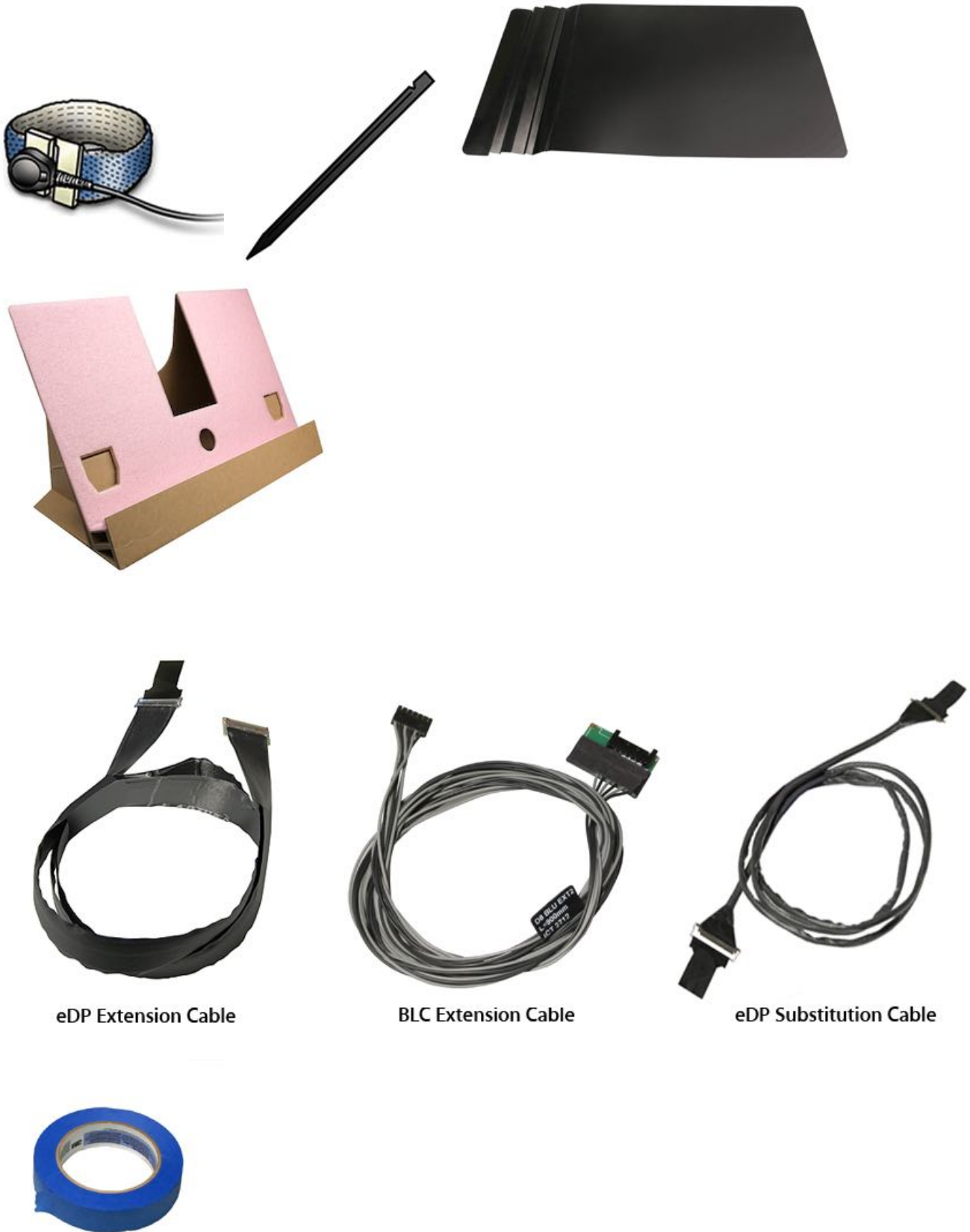
- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch\): Safety](#)
- [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#)
- [TP1637: iMac Pro \(2017\): Safety](#)



Tools

- ESD wrist strap and mat
- Black stick
- Power supply protective covers, pack of two (923-0189)
- LCD service support stand, iMac (923-0416)
- Kit, display extension cable set (076-1431) for iMac (27-inch, Late 2012 and Late 2013)

- Kit, display extension cable set (076-00010) for iMac (Retina 5K, 27-inch, Late 2014–2017)
- Kit, display extension cable set (076-00373) for iMac Pro (2017)
- Painter's tape



Note: The iMac (27-inch, Late 2013) display and extension cable kit are shown for the procedures. Follow the same setup steps and procedures if testing the iMac (Retina 5K, 27-inch, Late 2014–2017) display or the iMac Pro (2017), but use the

correct kit for each.

- iMac (Retina 5K, 27-inch, Late 2014–2017): 076-00010
- iMac Pro (2017): 076-00373

Procedure #1: Testing the System With the Panel Off, Using Extension Cables

This procedure allows you to test the system with the panel off in order to ensure everything is functioning before securing the panel with very high bond (VHB) adhesive strips.

First Steps

For iMac (27-inch, Late 2012–2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

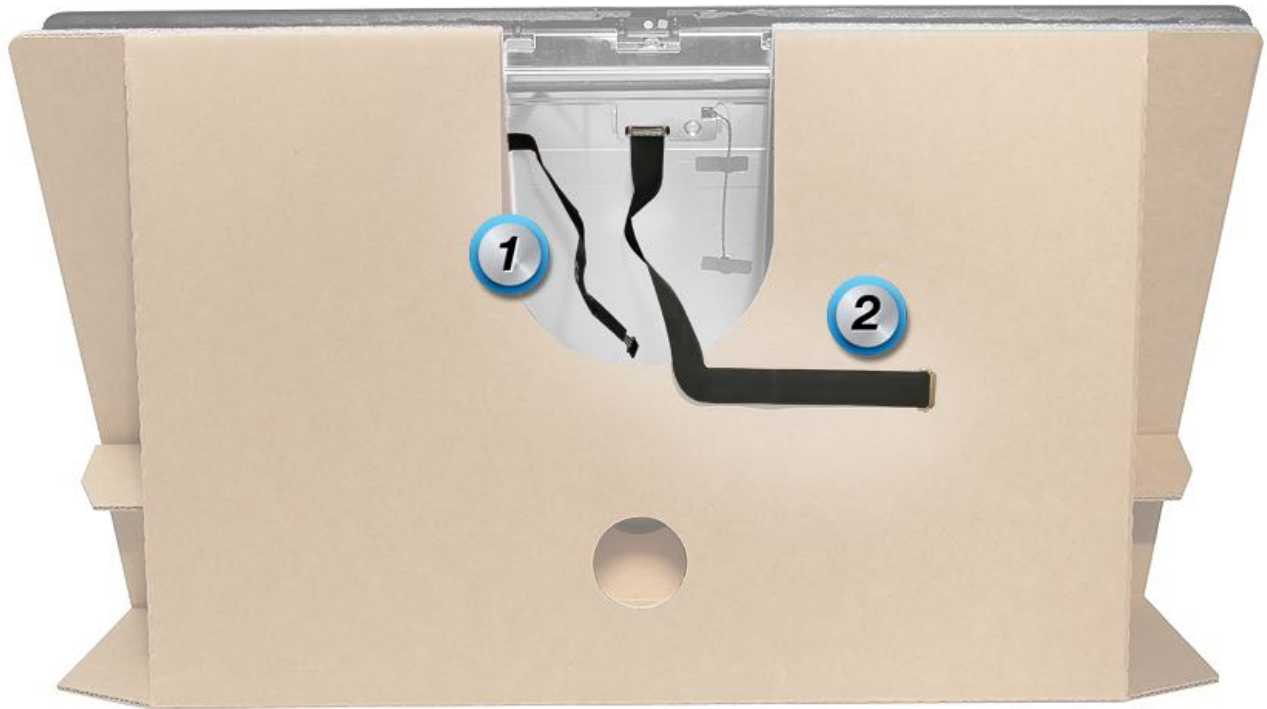
For iMac Pro (2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the LCD backlight cable (#1) and eDP (#2) cable are facing you.



3. Locate the eDP extension cable in the kit.



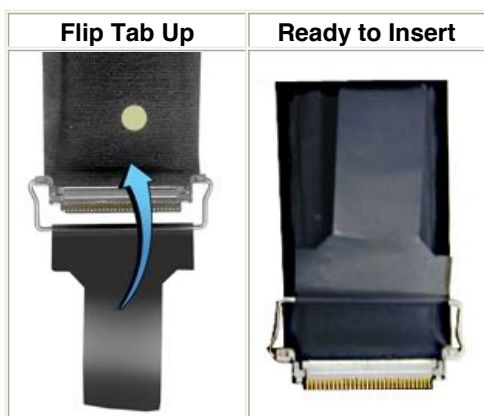
4. Either end of the eDP substitution cable can connect to the logic board; the other end connects to the display.

Important: Each end of the eDP extension cable has a gold dot to indicate cable orientation. Orient the cable with the gold dot side up when connecting the eDP extension cable to the logic board connector and the end of the LCD eDP cable. Connecting cables upside down (with the brass connector facing up) will damage the logic board and/or the LCD panel.

Note: With proper care, cables will last for approximately 50 insertions. After 50 insertions, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).

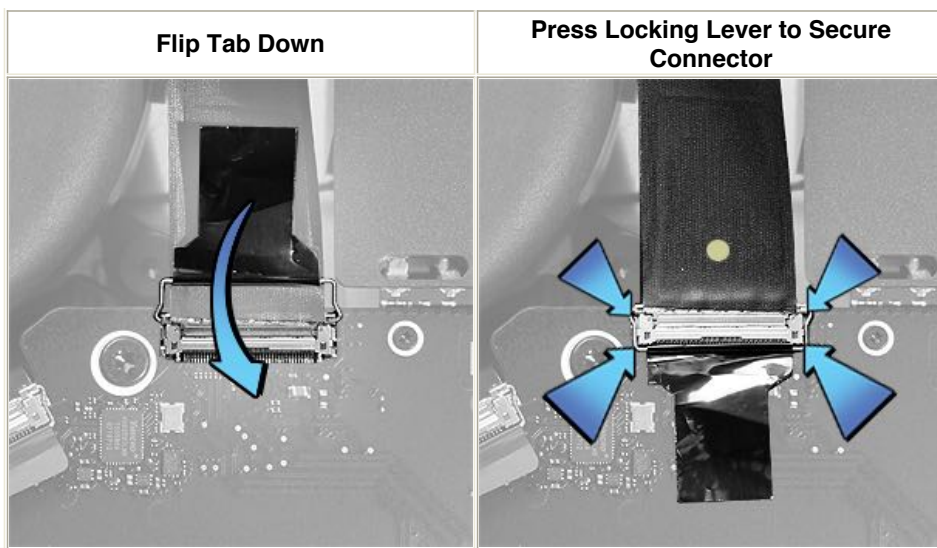


5. Flip the black tab up before connecting the eDP extension cable to the logic board connector.

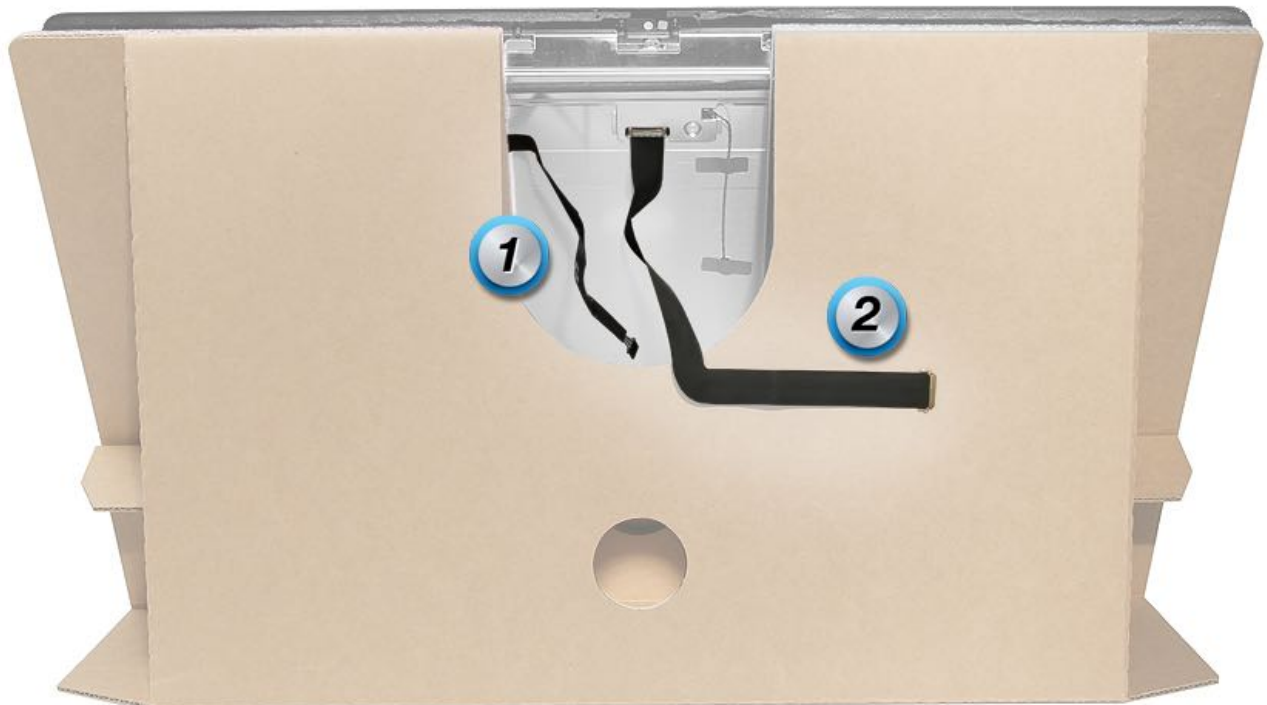


6. With the iMac unplugged, connect the extension cable to the logic board connector. The cable should be aligned straight on with the connector and never inserted at an angle. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever without the black tab may cause damage to the logic board and/or the LCD panel.

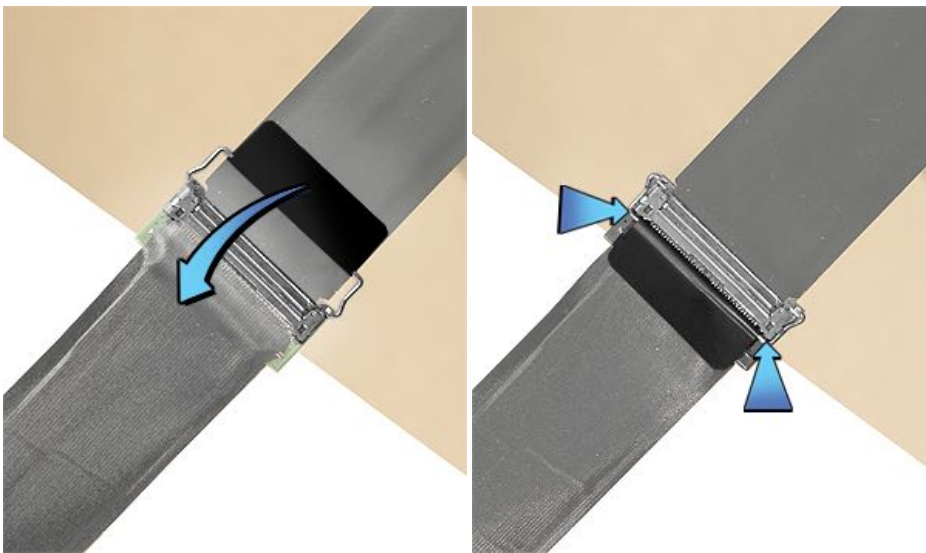
- Verify that each end of the cable has the gold dot side up.
- Check that the connector is fully seated.
- Flip the black tab down.
- Press the locking lever to secure the cable to the logic board.



7. Secure the logic board end of the eDP extension cable to the speaker with painter's tape (see step 10).
8. Connect the other end of the eDP extension cable to the end of the dangling DisplayPort cable (#2).



9. Securely mate the cable connectors. Flip the black tab over and press the locking lever bar around the connector to secure the cables.



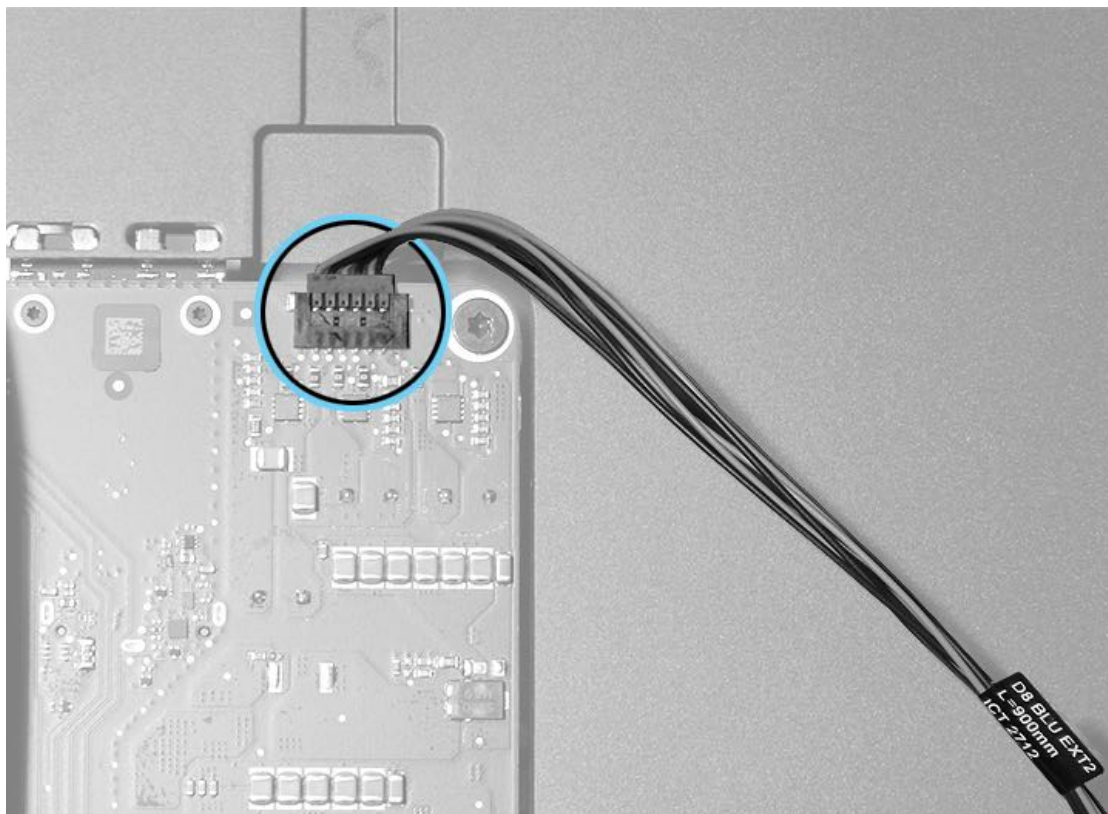
10. The eDP extension cable will look like the image below when connected properly.



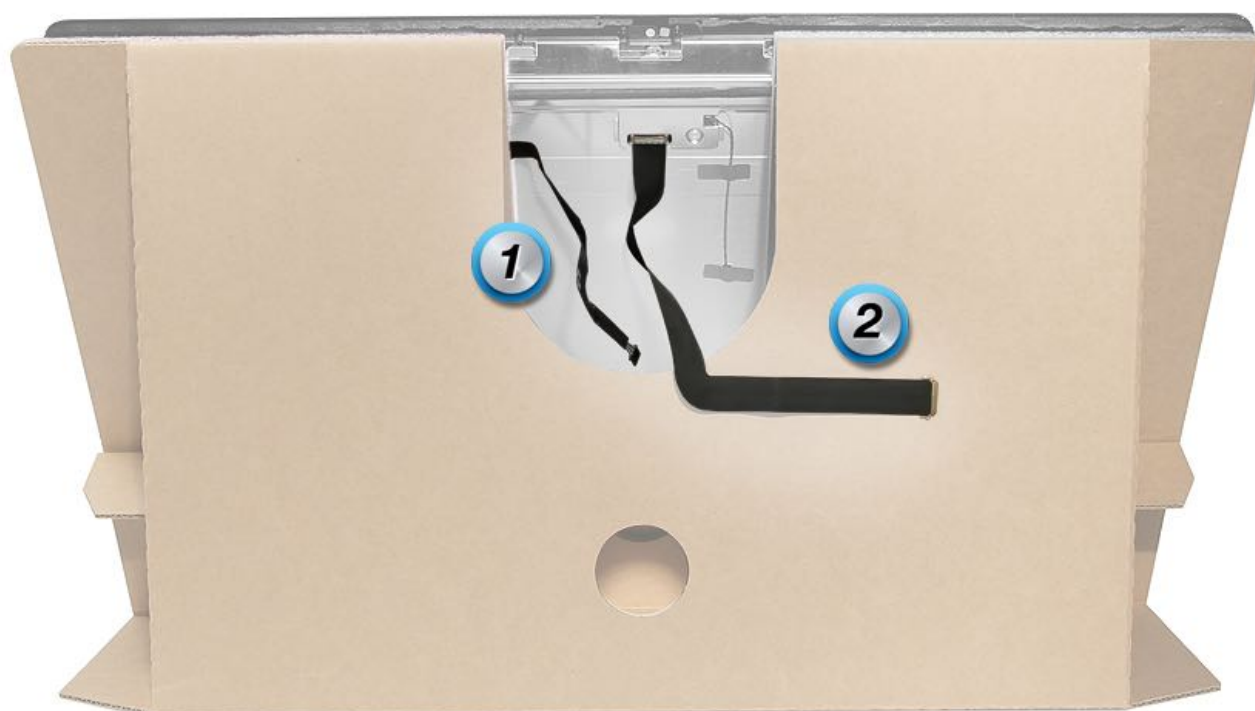
11. Next, locate the backlight extension (BLC) cable.



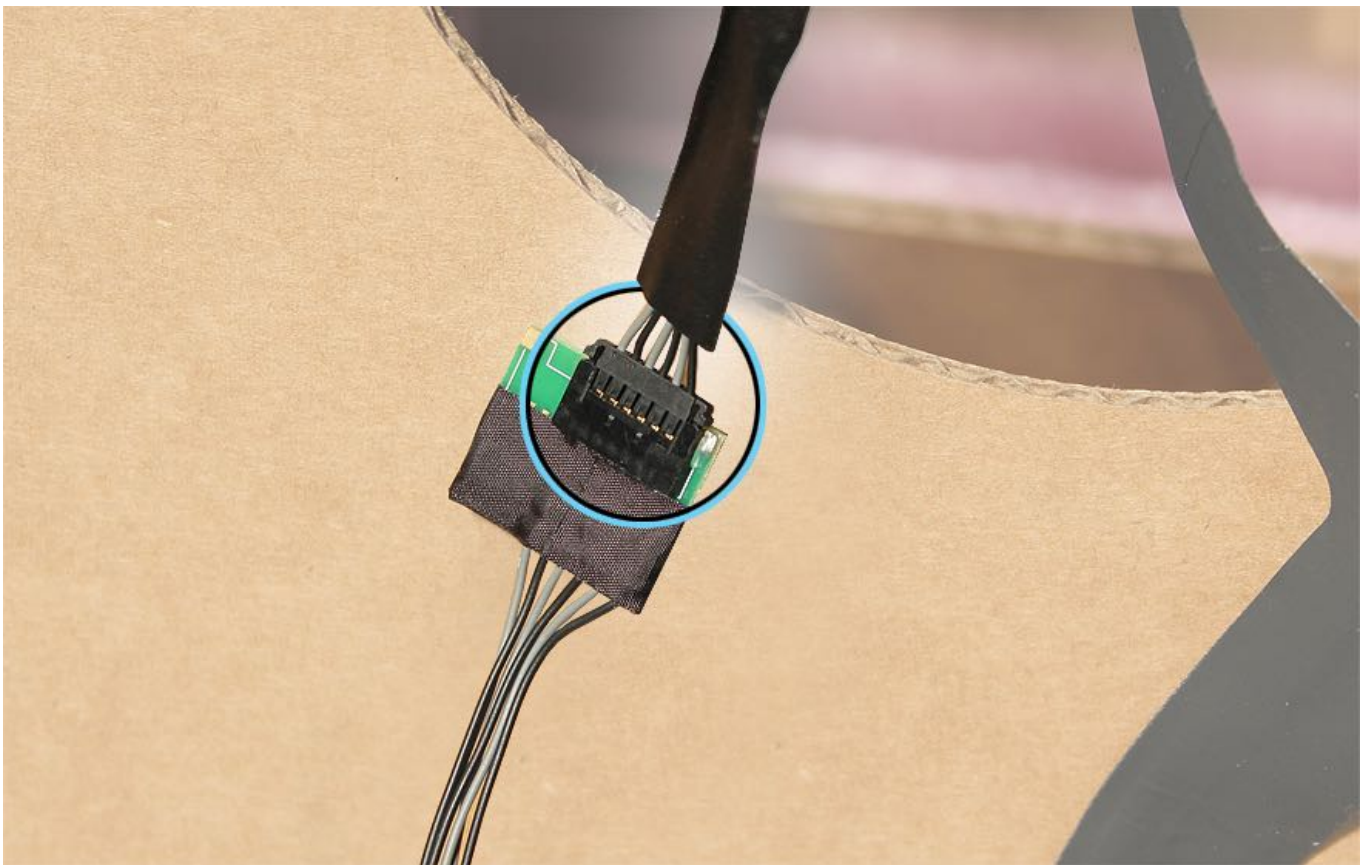
12. With the iMac unplugged, connect the backlight extension cable to the backlight connector on the logic board.



13. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).

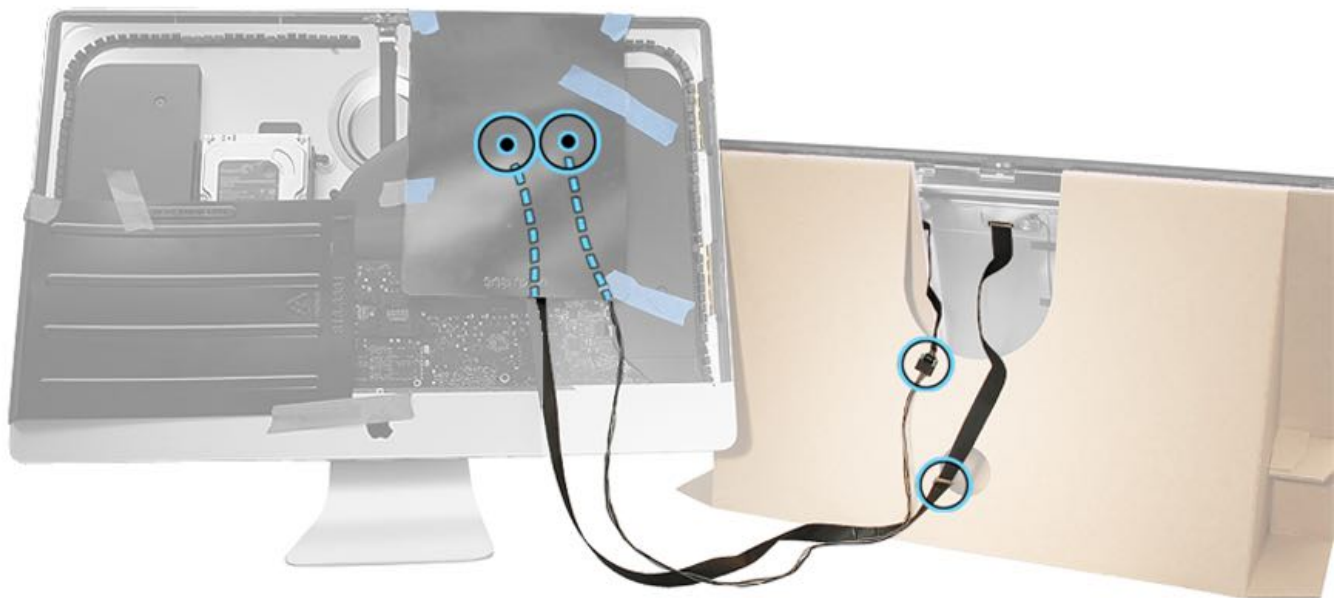


14. Securely mate the backlight extension cable with the panel's backlight cable connector.



15. Locate the two power supply covers. With the iMac unplugged, position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. Proper eDP and backlight extension cable setup is shown below.

16. Attach the power cord to the iMac and start up the system to verify system functionality.



Procedure #2: Testing the Panel with the eDP Substitution Cable

This procedure tests an eDP cable to determine whether the issue is with the eDP cable. Remove the “suspect” eDP cable from the circuit and replace it with the eDP substitution cable.

First Steps

For iMac (27-inch, Late 2012 – 2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

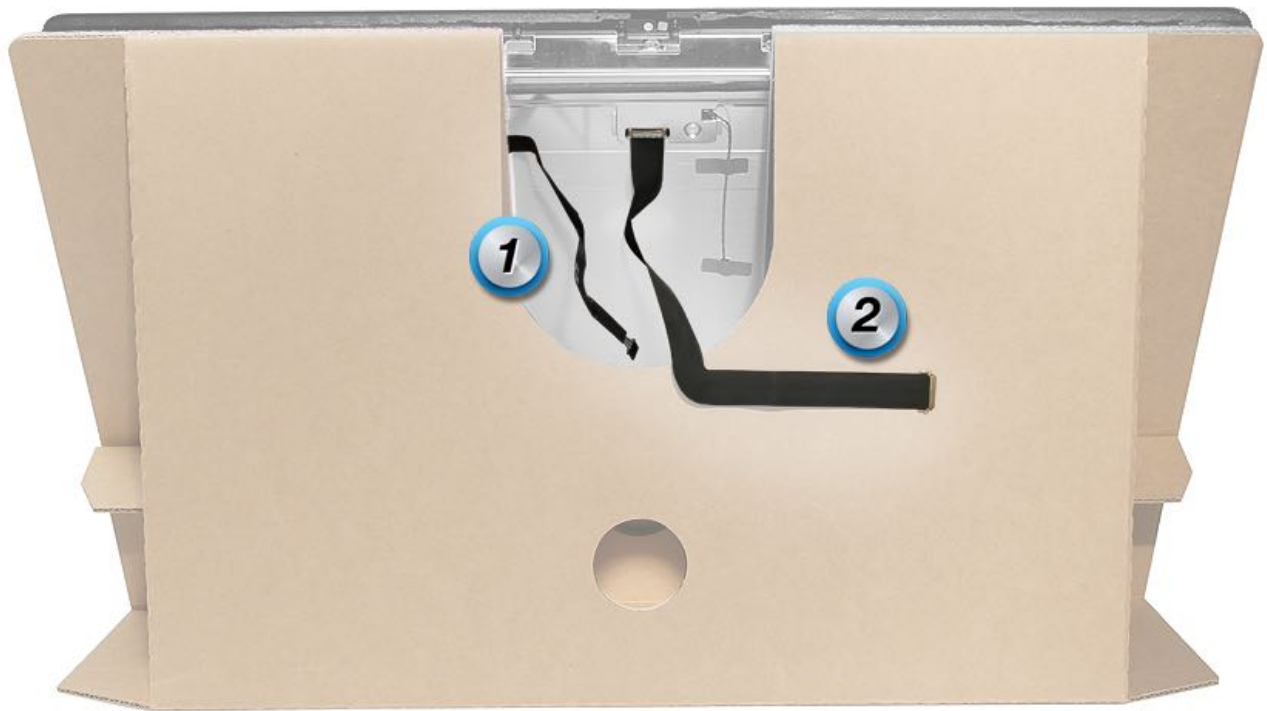
For iMac Pro (2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

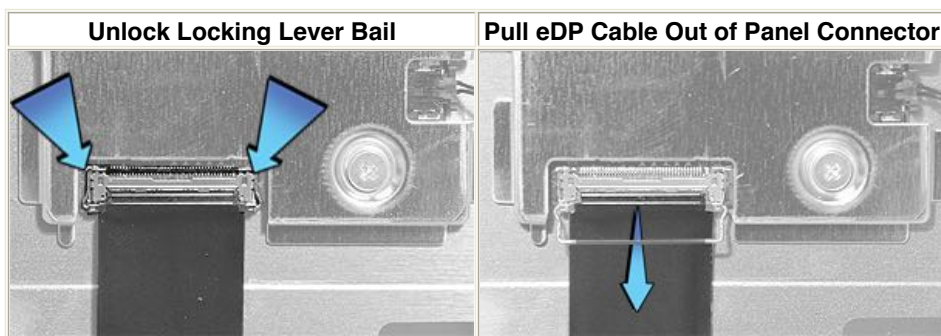
1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the backlight cable (#1) and eDP (#2) cable are facing you.



3. Disconnect the eDP cable from the connector on the LCD panel. Use your fingernail to flip the locking lever bail. Pull the cable out of the connector.



4. Locate the eDP substitution cable.



5. Either end of the eDP substitution cable can connect to the logic board; the other end connects to the display.

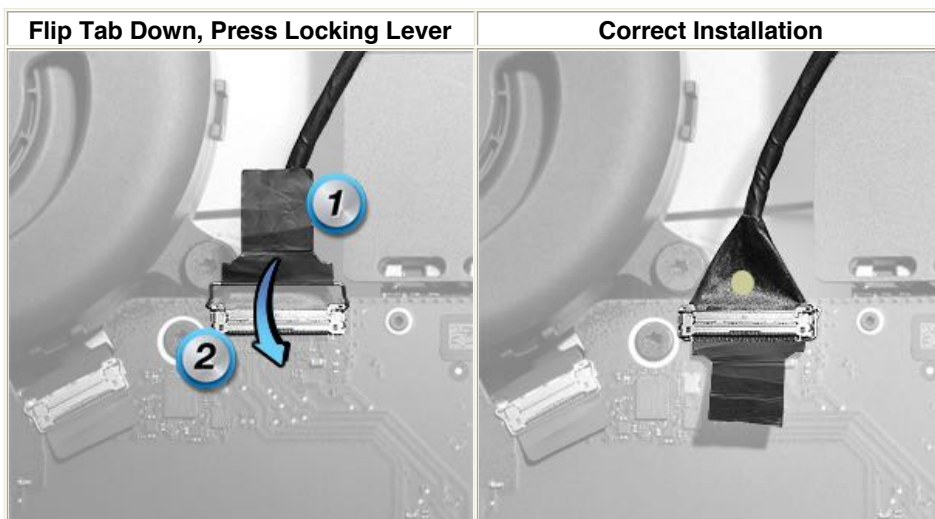
Important: Each end of the eDP substitution cable has a gold dot to indicate the cable orientation. Orient the cable with the gold dot side up when connecting the eDP substitution cable to the logic board and to the connector on the LCD panel. Connecting the cable upside down (with the brass connector facing you) will damage the logic board and/or the LCD panel.

Note: With proper care, cables will last for approximately 50 insertions. After 50 insertions, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).

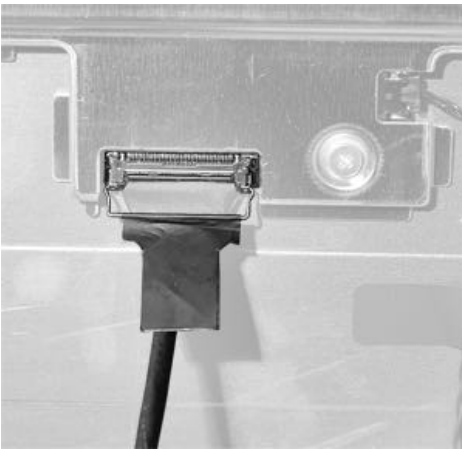


6. With the iMac unplugged, connect one end of the eDP substitution cable to the connector on the logic board. The cable should be aligned straight on with the connector and never inserted at an angle. The eDP substitution cable is shown properly connected to the logic board. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever without the black tab may cause damage to the logic board and/or the LCD panel.

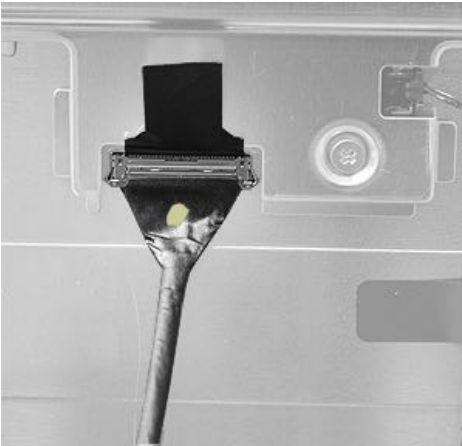
- Verify that each end of the cable has the gold dot side up.
- Check that the connector is fully seated.
- Flip the black tab down (#1).
- Press the locking lever (#2) to secure the cable to the logic board.



7. Connect the other end of the eDP substitution cable to the eDP connector on the back of the LCD panel.



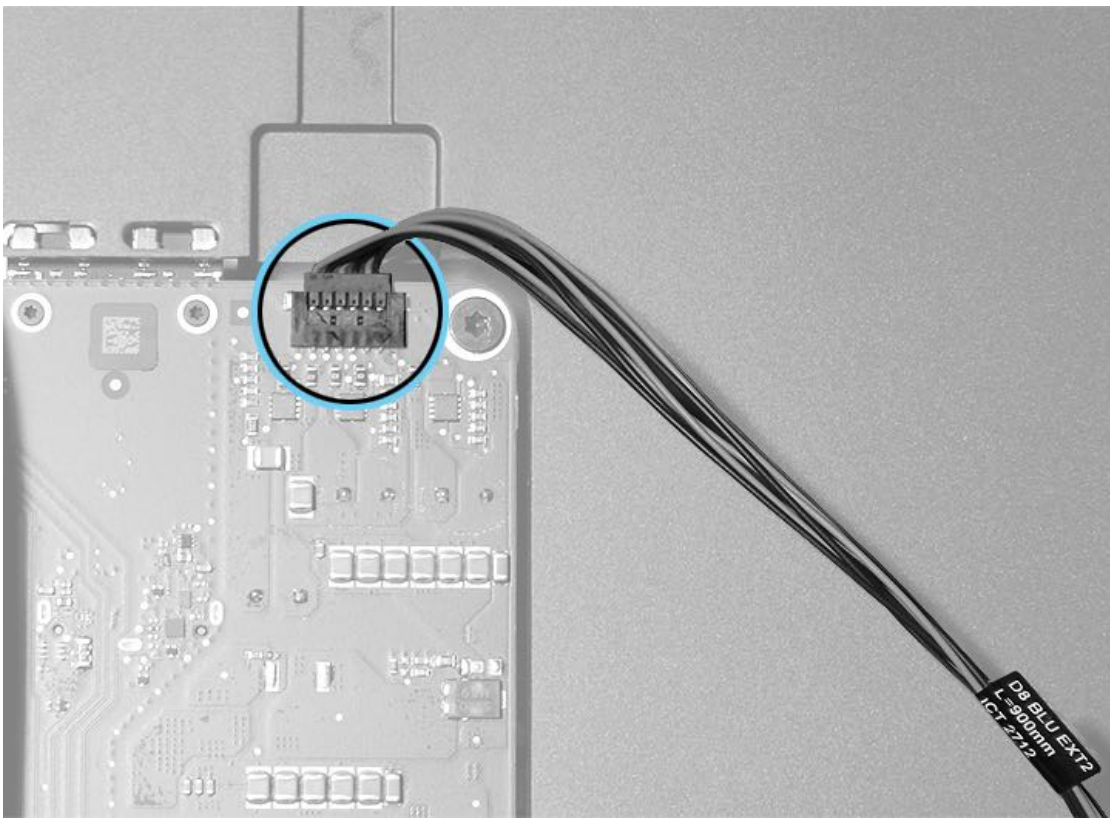
8. Flip the black tab up and press the locking lever bar to secure the cable to the connector on the panel.



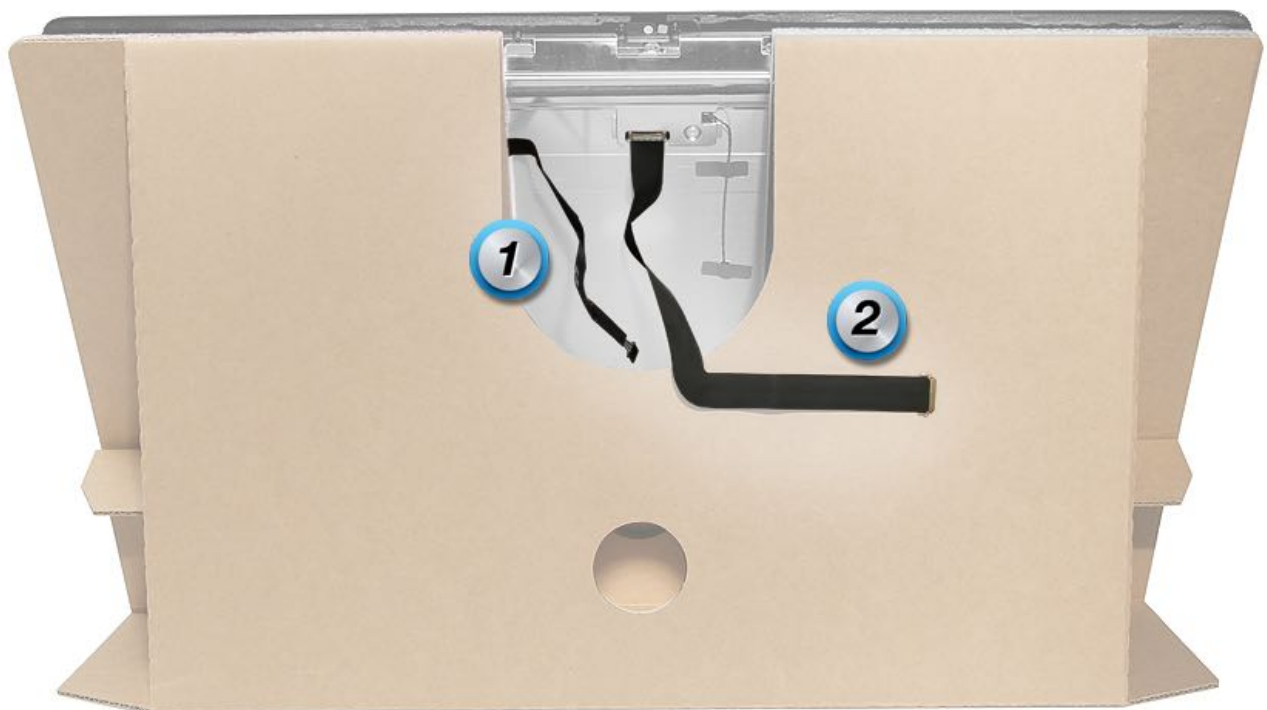
9. Locate the backlight extension cable (BLC).



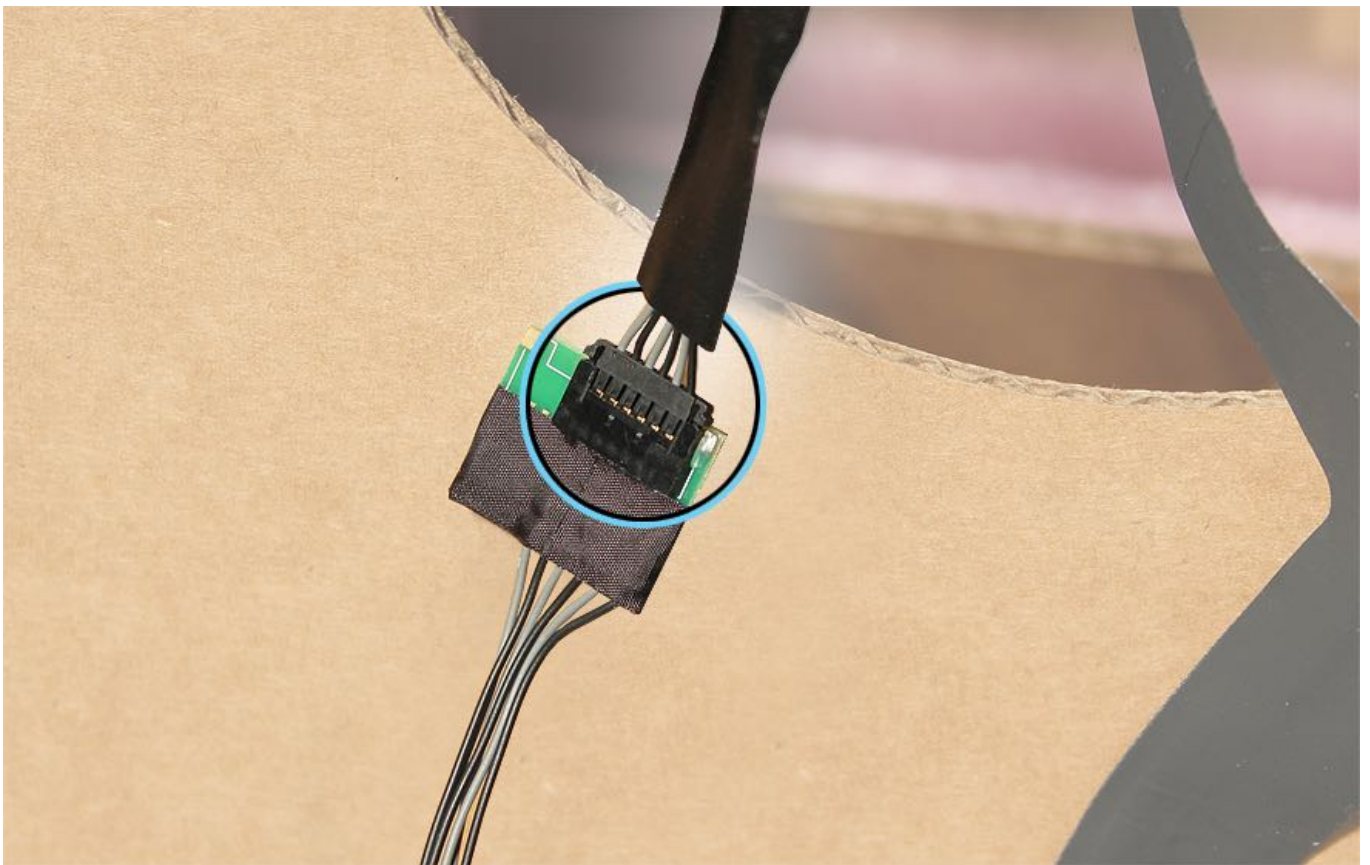
10. With the iMac unplugged, connect the backlight extension cable to the backlight connector on the logic board.



11. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).

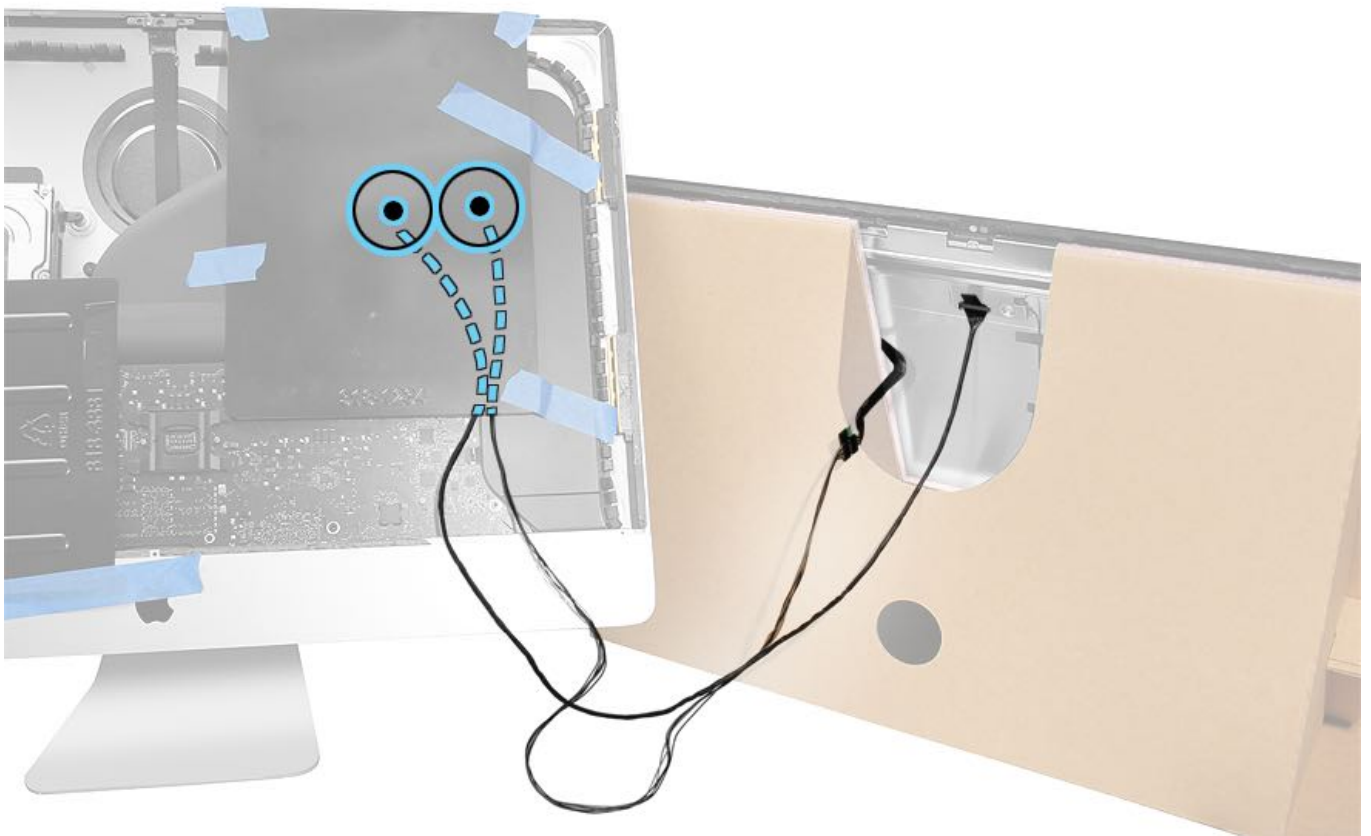


12. Securely mate the backlight extension cable with the panel's backlight cable connector.

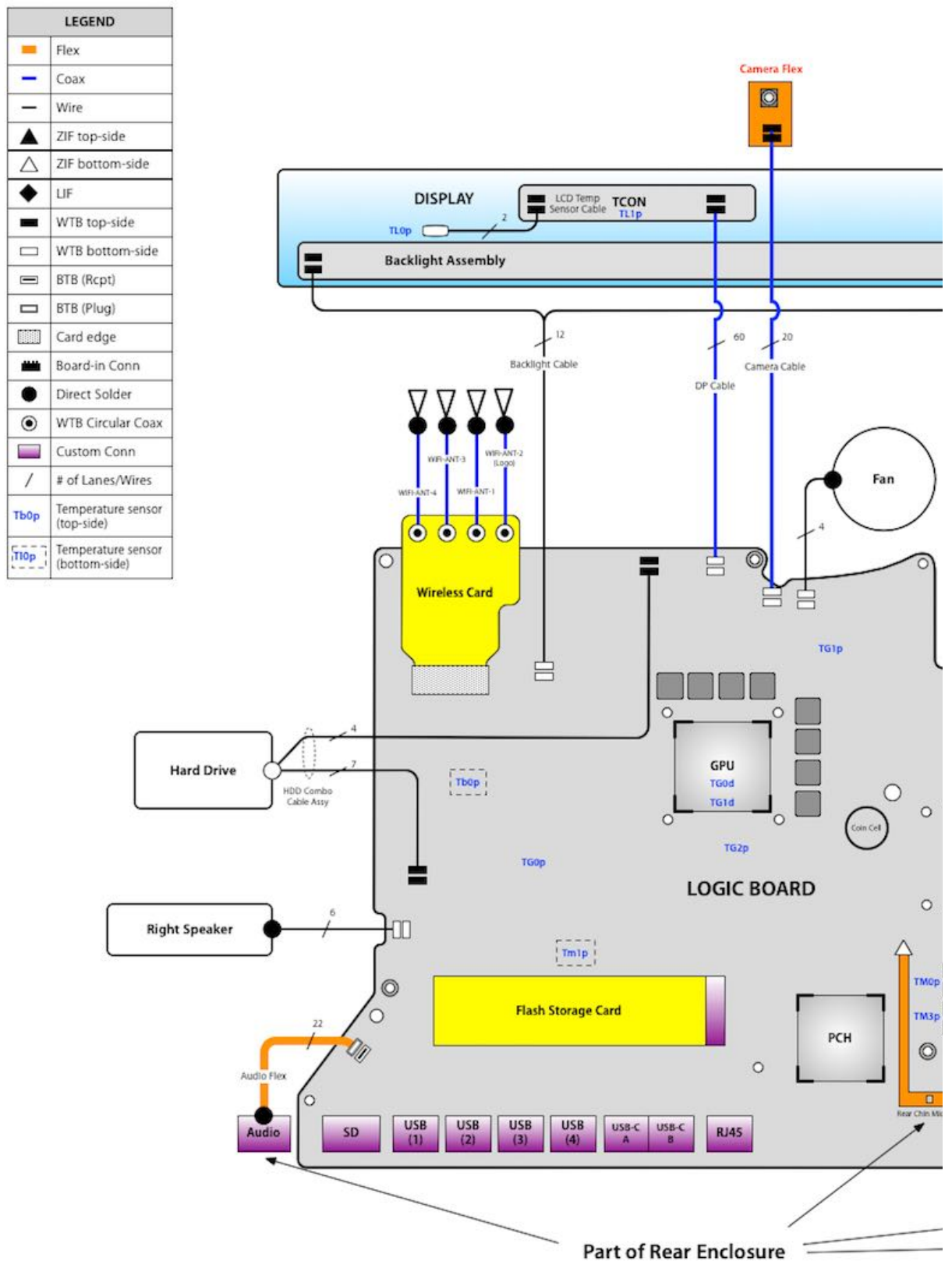


13. Locate the two power supply covers. With the iMac unplugged, position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. The image below shows the proper cable setup for the eDP substitution cable and backlight extension cable.

14. Attach the power cord to the iMac and start up the system to verify eDP cable functionality.



Thermal sensors and cable connector locations are shown below.



The diagram illustrates a comprehensive computer system architecture, organized into several main functional areas:

- POWER SUPPLY:** An AC Inlet feeds a 25A @ 12V Power Supply. It provides power to the system via a PSU DC Power Cable and a PSU Signal Cable. A Fan is connected to the power supply.
- LOGIC BOARD:** The central hub containing the CPU (KabyLake-S), GPU, and various memory modules (DDR4 SO-DIMM, 4, 8, 16GB). It also houses the SMC (System Management Controller), PCH (Platform Controller Hub), and various sensors (Power, Temp, I/O).
- PERIPHERALS:** Includes a 3V Battery, ROM, HDD (3.5", 7200 RPM, 1, 2, 4TB), and various cables (SATA Combo, USB-C, Audio, etc.).
- INTERFACES:** Shows connections for various protocols like PCIe (Gen3 x4, Gen1 x1), USB (USB2.0, USB3.0), SATA, and I2C.

The diagram uses a color-coded system: Blue for Power Supply, Green for Logic Board, and Yellow for Peripherals. It also includes a legend for the color coding and a list of components and their connections.



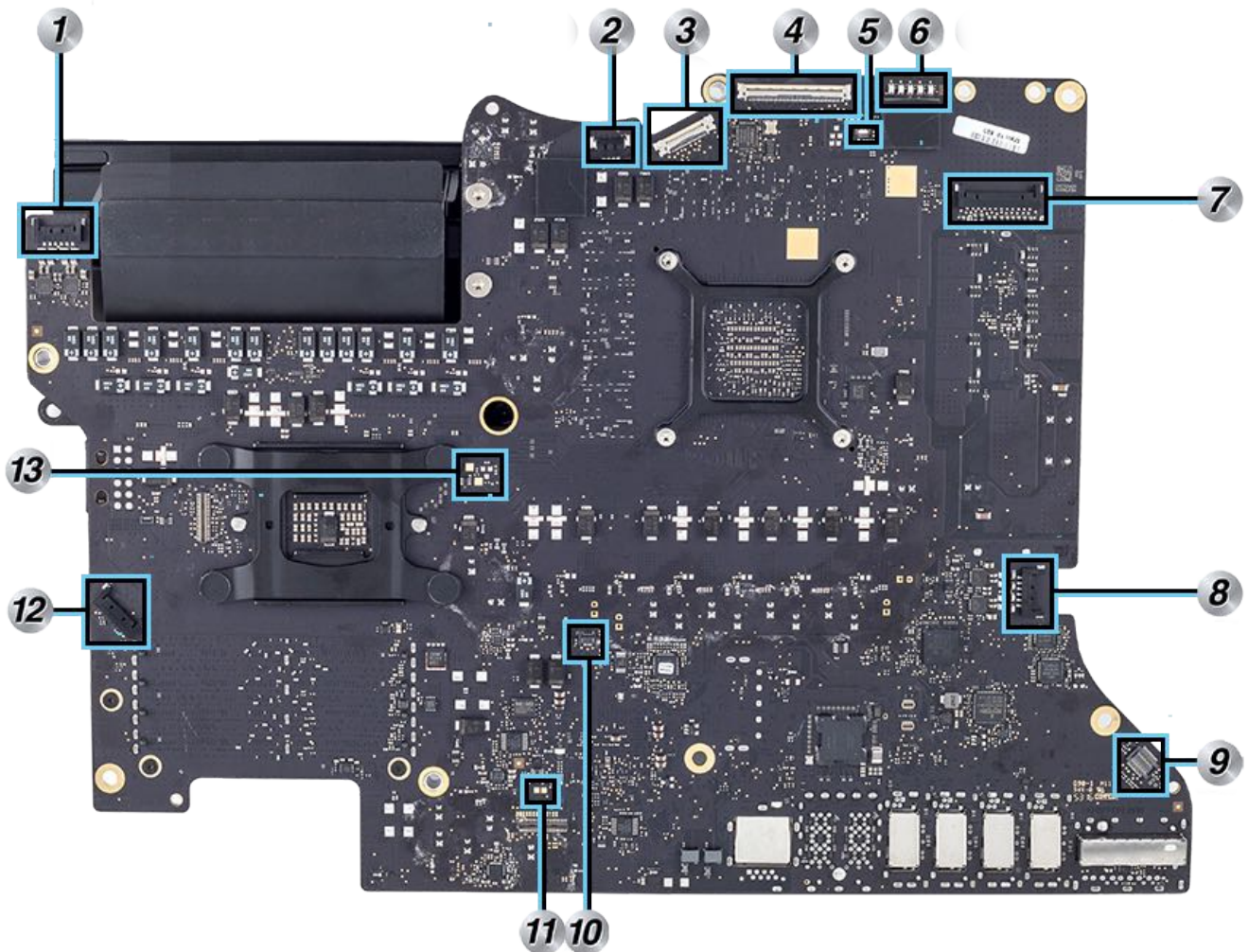
Functional Overview

Functional Overview for iMac (Retina 5K, 27-inch, 2017)

For information on sensors and cable connections, refer to article [TP1560: Interconnect Diagram](#).

Front of Logic Board

Refer to this diagram for symptoms related to connectors on the front of the logic board.



1 = Left speaker

- No sound from left speaker
- Distorted sound from left speaker

2 = CPU blower fan

- System shuts down if fan is disconnected or blocked
- System freezes or kernel panics
- Noisy fan perception

3 = Camera, camera LED, and ambient light sensor (ALS)

- No camera function
- No LED when camera is on

4 = Internal DisplayPort video

- Poor or no video on internal display
- Open display fuse F4400 on logic board

5 = Display fuse (F4400)

- No video but LED backlight on internal display

6 = Diagnostic LEDs 1–5

- 1 = AC input voltage (trickle power present)
- 2 = Power supply DC output voltage
- 3 = Memory is functioning
- 4 = GPU is functioning
- 5 = Display panel is connected

7 = Display power (backlight control)

- No LED backlight on internal display
- Open backlight fuse F8100 on logic board

8 = Right speaker

- No sound from right speaker
- Distorted sound from right speaker

9 = Audio input/output

- No external analog audio input
- No external analog audio output
- No headset controls or mic input

10 = Microphone

- No input or distorted internal microphone input (with Internal Microphone selected in Sound Input Preferences)

11 = RTC reset pads (TP1902 and TP1093)

- Short across to reset Real Time Clock (RTC)

12 = Power on signal and power supply temperature sensor

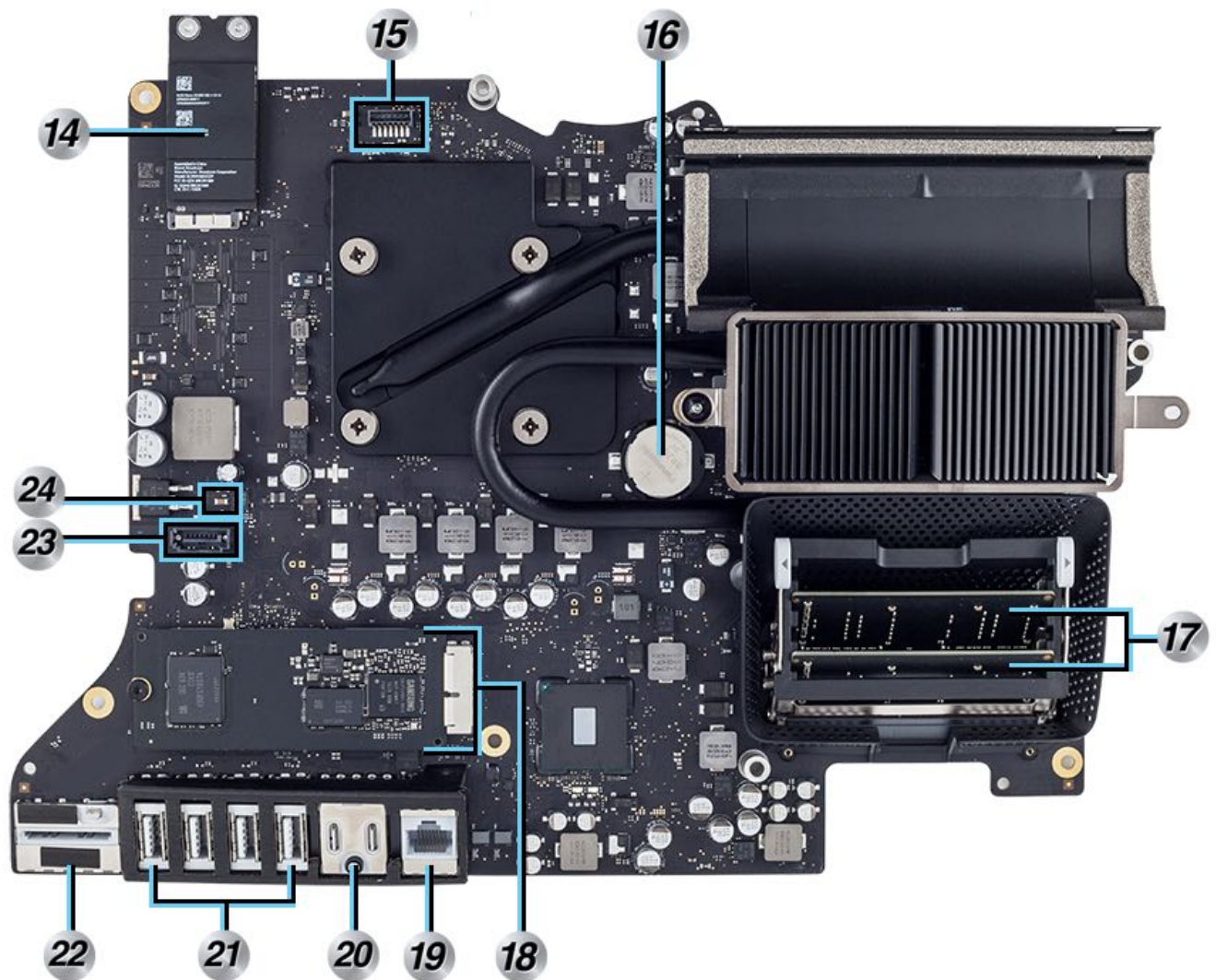
- No power
- Intermittent shutdown (if cable is pinched or damaged)
- Fan runs at full speed

13 = Backup battery test points (TP1900 and TP1901)

- Use to measure 3V DC backup battery coin voltage

Back of Logic Board

Refer to this diagram for symptoms related to the connectors on the back of the logic board.



14 = Wireless card

- Cannot enable Wi-Fi and/or Bluetooth
- Wi-Fi is not seen in System Info > Network > Wi-Fi
- Bluetooth is not seen in System Info > USB

15 = SATA hard drive power

- No SATA hard drive seen on SATA bus
- No boot from hard drive or Fusion drive

16 = Backup battery

- No power
- No video
- Beep tones on startup

17 = Memory

- No boot
- Beep tones on startup
- Freezes or kernel panics

18 = SATA flash storage data and power

- No flash storage seen in System Info

19 = Ethernet RJ-45

- No wired Ethernet connectivity
- Wired Ethernet data transfer issues

20 = USB-C ports (2)

- USB connectivity issues
- USB power issues
- No video to external display
- No audio to external display speakers
- Thunderbolt device not found
- Thunderbolt controller not recognized
- Thunderbolt driver issue
- Thunderbolt power issues

21 = USB ports (4)

- USB connectivity issues
- Data transfer issues

22 = SD Card

- No SD card seen in System Info
- Data transfer issues

23 = SATA hard drive data

- No SATA hard drive seen in System Info
- No boot from hard drive

24 = Backlight fuse (F8100)

- No LED backlight on internal display

Bluetooth Device Connection Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, logic board, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD) / flash storage card, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bluetooth service not availableCannot turn Bluetooth onBluetooth can be turned on, but the computer is unable to pair with a known-good Bluetooth deviceIntermittent loss of communication with paired Bluetooth deviceData transfer over Bluetooth times out or is too slow <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">In System Preferences > Bluetooth, check that Bluetooth is on.Attempt to pair the computer with a known-good Bluetooth keyboard, mouse, or trackpad.Reset the Bluetooth device or delete the pairing (if applicable).Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.If the customer is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers to identify possible interference with Wi-Fi and Bluetooth communications if the device is positioned near their antennas.If the user's computer pairs Bluetooth normally at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. Refer to article HT201542: Potential sources of Wi-Fi and Bluetooth interference.Follow steps listed in HT204066: Use Bluetooth Diagnostics to help you isolate issues with wireless devices.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Hardware > USB Device Tree to verify that wireless card is recognized. Does System Information or MRI detect Bluetooth hardware?	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to “Wireless Card Not Recognized” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
2.	Open System Preferences > Bluetooth. Remove all paired devices. Pair the computer with a known-good Bluetooth device. Does the computer pair with a known-good Bluetooth device?	Yes	Go to the “External Apple Bluetooth Peripherals” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	Start up the computer to an up-to-date, bootable macOS volume. Try to connect to a known-good Bluetooth device. Compare Bluetooth performance and reliability to a known-good computer of similar type and Bluetooth specification. Is the pairing issue resolved and is Bluetooth performance as expected?	Yes	Reinstall macOS on the user’s computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Locate the A3 Bluetooth antenna (second from left), and inspect antenna’s cable and connector for any damage. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Are antenna cable and connector in good condition?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
5.	Locate A3 Bluetooth antenna port on wireless card (second from left), and verify it is not damaged, loosened, or unsoldered. Reseat antenna connector to wireless card. Make sure connection is secure and correctly aligned. Is A3 antenna connector port in good condition and securely seated?	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Replace wireless card. Verify issue resolved.	N17	WIRELESS DEVICE
6.	Reseat A3 antenna cable connection to wireless card (second from left). Connect an external display and try to pair with a known-good Bluetooth device. Did computer pair successfully with known-good Bluetooth device?	Yes	Issue resolved by reseating Bluetooth antenna. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	The Bluetooth antenna is located on upper edge of the enclosure and is available as a standalone part. Do you have immediate access to a known-good Bluetooth antenna?	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC
8.	Substitute known-good (upper) Bluetooth antenna. Connect an external display and try to pair with a known-good Bluetooth device. Did computer pair successfully with known-good Bluetooth device?	Yes	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC
		No	Replace user's wireless card. Reinstall user's Bluetooth antenna. Verify issue resolved.	N15	WIRELESS DEVICE
9.	Pair with a known-good Bluetooth device and verify that the connection is sustained for several minutes. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is issue resolved?	Yes	The issue is resolved.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Ethernet Issues

Unlikely causes:

AirPort/Bluetooth antenna(s), battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No Ethernet device present.• Unable to access Ethernet network resources.• Ethernet device shows no connection.• Ethernet device unable to get an IP address.• Slow Ethernet network performance. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Verify the network setup by accessing it directly via a known-good computer's Ethernet port.2. Launch System Information. Verify that the computer's Ethernet port appears in the Network devices tree.3. Test with known-good network hardware and an Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).4. Using known-good network hardware and cable, start up from a known-good, up-to-date macOS volume. Go to Network Utility > Info and verify that Link Status is "Active."5. Check network settings. If a known-good DHCP server is available, set System Preferences > Network > Ethernet to Using DHCP. Verify the IP address. (If it begins with 169.x.x.x, the system was unable to get a valid IP address.)6. When started up from user's OS, revert to default network settings by creating a new location in System Preferences > Network.7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates.8. Run AST 1 or AST 2 Mac Resource Inspector (MRI) and check results to verify that Ethernet hardware is detected.9. If AST 1 or AST 2 is not available, use System Information to verify that Ethernet hardware is recognized. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Ethernet port for dust, debris, damage, or bent pins. Use compressed air to remove debris. Plug in a known-good Ethernet cable and make sure all pins make physical contact with connector. Are any Ethernet port pins damaged or insufficiently contacting the known-good Ethernet connector?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
2.	Inspect logic board, Ethernet port, and enclosure for dents, scratches, or other indications of impact or abuse. Does accidental damage appear to be cause of issue?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M10	MLB
3.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Verify issue resolved.	M10	MLB
		No	Issue resolved. Return computer to user using correct positioning.	\$(nodeText.noSymptomCode)	
4.	Ensure that the user's computer is connected to the Internet using a known-good Ethernet cable, and that Wi-Fi is turned off so that all network traffic goes through built-in Ethernet. Start up the computer using macOS Recovery or an up-to-date, bootable macOS volume. Hold down Command-R during startup to restart from the recovery partition. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version . Open Safari and attempt to access a known-good external web page such as www.apple.com to verify Ethernet connectivity. Look for the web page to load, or for a timeout indicating that the page did not load. Are Ethernet network resources accessible starting from recovery partition or a known-good OS?	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	Restart the user's computer to the built-in macOS boot volume.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
	<p>In System Preferences > Network > Ethernet, verify that the link status is Connected (green dot) and that a valid IP address is listed. Connect the computer to an Ethernet network with a known-good DHCP server. Make sure static DHCP maps or filtering are not preventing address allocation.</p> <p>Note: DHCP allocation may not be instantaneous, depending on network. Retest.</p> <p>Is Ethernet link status active?</p>	No	Replace logic board. Verify issue resolved.	M10	MLB
6.	Go to System Preferences > Network > Ethernet and obtain router IP address. Use Network Utility to ping router IP address. Use a simple hub/switch environment.	Yes	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.	\$(nodeText.yesSymptomCode}	
	Is Network Utility able to ping router IP address?	No	Go to step 7.	\$(nodeText.noSymptomCode}	
7.	Perform network testing from previous step, using same cable and network, but with a known-good computer.	Yes	Replace logic board. Verify issue resolved.	M10	MLB
	Is network performance of user's computer inferior to known-good computer?	No	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	1. Connect Ethernet cable to a known-good network with a DHCP server. 2. In System Preferences > Network > Ethernet, verify link status is Connected (green dot). 3. Configure TCP/IP settings to Using DHCP and check that a valid IP address is obtained from server (not a self-assigned one starting with 169.x.x.x). 4. Launch web browser and verify that you can access websites and download files. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

Wi-Fi Connection Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, fan, flash storage card / solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, logic board, memory, power supply, right speaker, stand

Quick Check

Symptoms	Quick Check
<p>Wi-Fi interface is present and can be enabled but the following symptoms occur during use:</p> <ul style="list-style-type: none"> • Unable to find or connect to wireless networks • Slow or stalled data transfers • Intermittent connection dropouts <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>On user's computer:</p> <ol style="list-style-type: none"> 1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. 2. Using Ethernet network interface, connect to Internet, then check for and apply latest software and firmware updates. 3. Start up computer using recovery partition or an up-to-date, bootable macOS volume, and attempt to connect to a wireless network. 4. On a known-good computer, go to System Preferences > Sharing and select Internet Sharing. Configure the known-good computer to "Share your connection from" > Ethernet and "To computers using" > Wi-Fi. Try to connect user's computer to the newly created wireless network. 5. Using a known-good OS and base station, compare Wi-Fi throughput in Activity Monitor > Network to that of a similar computer. 6. Refer to article HT202663: Check for Wi-Fi issues using your Mac to familiarize yourself with the macOS Wireless Diagnostic utility. 7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 8. Reset the SMC using the procedure for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac. <p>If the issue cannot be reproduced on site, prompt the user to check their Wi-Fi base station for the following:</p> <ol style="list-style-type: none"> 1. Check for base station firmware updates. 2. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference. 3. Make sure base station is not using MAC address filtering or has not created a hidden network. 4. Make sure base station is not set to low-power transmission mode. 5. Make sure base station is not using an unsupported connection and encryption protocol. 6. Check for Wi-Fi channel overlap (a nearby base station using an adjacent channel). 7. Connect to a known-good test network. 8. Test in a different environment. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code
1.	Run Mac Resource Inspector (MRI) or check System Information to see whether the wireless card is recognized.	Yes	Go to step 2.	\$(nodeText.yesSymptomCod
	System Information: <ul style="list-style-type: none"> Network > Wi-Fi > Interfaces <p>Is Wi-Fi service detected in MRI or System Information?</p>	No	Go to “Wireless Card Not Recognized” troubleshooting flow.	\$(nodeText.noSymptomCode
2.	Run Wireless Diagnostics by holding down the Option key, clicking the wireless icon in the menu bar, and then choosing Open Wireless Diagnostics.	Yes	Go to step 3.	\$(nodeText.yesSymptomCod
	Wireless Diagnostics can also be found at: /System/Library/CoreServices/Applications/WirelessDiagnostics.app Does the computer complete Wireless Diagnostics with no issues?	No	Go to step 4.	\$(nodeText.noSymptomCode
3.	Connect to a known-good wireless network and open Wireless Diagnostics > Window > Performance. Review the quality graph to evaluate the signal quality of the wireless connection. Verify that the signal is good or excellent, and that the transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available, switch between 2.4GHz and 5GHz networks to verify that the signal quality is comparable to a known-good computer.	Yes	Wi-Fi performance is within specification. Verify that the issue is resolved.	\$(nodeText.yesSymptomCod
	Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor > Network. Are the performance and throughput comparable between the user’s computer and a known-good computer?	No	Go to step 4.	\$(nodeText.noSymptomCode
4.	Start up computer using an up-to-date, bootable macOS volume. Attempt to reproduce the Wi-Fi performance or connection issue.	Yes	Go to step 5.	\$(nodeText.yesSymptomCod
	Does issue persist with known-good OS?	No	Refer to HT204319: macOS versions and builds included with Mac computers and install correct version of macOS. Check for and apply latest software and firmware updates. Verify issue resolved.	\$(nodeText.noSymptomCode
5.	Turn off Bluetooth to eliminate potential interference. Check for other interference such as microwave ovens or cordless phones. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference . Change base station channel.	Yes	Go to step 6.	\$(nodeText.yesSymptomCod
	Does the issue persist?	No	Issue caused by interference. Remove sources of interference, or use a different Wi-Fi channel or mode (2.4GHz or 5GHz). Verify issue resolved.	\$(nodeText.noSymptomCode

	Check	Result	Action	Code
6.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate the three Wi-Fi antennas and inspect each antenna's cable and connector for any damage.</p> <p>Are Wi-Fi antenna cables and connectors in good condition?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptomCod
		No	Go to step 7.	\$(nodeText.noSymptomCode
7.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03
		No	<p>ESCALATION REQUIRED.</p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99
8.	<p>Locate Wi-Fi antenna connector ports on wireless card and verify that they are not damaged, loosened, or unsoldered. Reseat antenna connectors to wireless card. Make sure connections are secure and correctly aligned.</p> <p>Are Wi-Fi antenna connector ports in good condition and securely seated?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCod
		No	Replace wireless card. Verify issue resolved.	N17

	Check	Result	Action	Code
9.	<p>To verify Wi-Fi performance and reliability, start up computer using an up-to-date, bootable macOS, 10.8.4 or later volume for access to Wireless Diagnostics application. See article HT202663: Check for Wi-Fi issues using your Mac to familiarize yourself with wireless diagnostic utilities.</p> <p>Connect to a known-good wireless network and open Wireless Diagnostics > Window > Performance. Review Quality and Rate graphs to evaluate signal of wireless connection. Verify signal is good or excellent and transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available, switch between 2.4GHz and 5GHz networks to verify signal quality is comparable to a known-good computer. Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor > Network.</p> <p>Are performance and throughput comparable between user's computer and a known-good computer?</p>	Yes	Wi-Fi performance is within specification. Verify issue resolved.	\$(nodeText.yesSymptomCode)
		No	Go to step 10.	\$(nodeText.noSymptomCode)
10.	<p>To completely troubleshoot this issue, the following known-good parts are required:</p> <ul style="list-style-type: none"> Wireless card Standalone Wi-Fi antennas (if available) <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)
		No	Replace wireless card. Verify issue resolved.	N14
11.	<p>Substitute a known-good wireless card and retest, comparing performance and throughput of user's computer with known-good computer.</p> <p>Are performance and throughput comparable between computers?</p>	Yes	Replace wireless card. Verify issue resolved.	N14
		No	Go to step 12.	\$(nodeText.noSymptomCode)
12.	<p>Substitute known-good Wi-Fi antenna. Connect external display and retest, comparing performance and throughput of user's computer with known-good computer. Repeat with other antennas.</p> <p>Are performance and throughput comparable between computers?</p>	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99

	Check	Result	Action	Code
13.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03
		No	<p>ESCALATION REQUIRED.</p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99
14.	<p>Connect to a known-good wireless network and retest data throughput, checking for adequate transfer speeds.</p> <p>Verify that wireless connection is sustained for several minutes.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>\$(nodeText.questionText)</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCod
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99

Wireless Card Not Recognized

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Wi-Fi cannot be enabled• Wi-Fi is not detected or available in System Information• Bluetooth cannot be enabled• Bluetooth is not detected or available in System Information• Wi-Fi and/or Bluetooth intermittently becomes disabled <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.2. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.3. Start up from recovery partition or an up-to-date, bootable macOS volume, and check for the following:<ul style="list-style-type: none">◦ Wi-Fi network interface presence in System Information and System Preferences > Network.◦ Bluetooth network interface presence in System Information and System Preferences > Bluetooth.4. Using Ethernet network interface, connect to the Internet, then check for and apply latest software and firmware updates.5. Reset the SMC using the procedure for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) to see whether wireless card is recognized.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Are both Wi-Fi and Bluetooth services detected in MRI?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
2.	Check MRI to see whether it detects local Wi-Fi network(s).	Yes	Go to “Wi-Fi Connection Issues” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Does MRI only fail the Wi-Fi Scan test?	No	Go to step 3.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	Determine whether the wireless issue is related to Bluetooth or Wi-Fi functionality.	Bluetooth	Go to “Bluetooth Device Connection Issues” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Is issue related to Bluetooth or Wi-Fi functionality?	Wi-Fi	Go to “Wi-Fi Connection Issues” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Issue resolved by reseating wireless card. Verify issue resolved.	`\${nodeText.yesSymptomCode}`	
	Remove display panel. Reseat Wireless Card connection to logic board. Connect an external display, and run MRI or check System Information for Wireless Card presence. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	Are both Wi-Fi and Bluetooth services detected in MRI or System Information?	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
	To troubleshoot this issue completely, a known-good wireless card is required. Do you have immediate access to a known-good wireless card?	No	Replace wireless card. Verify issue resolved.	N18	WIRELESS DEVICE
6.	Substitute a known-good wireless card. Connect an external display and run MRI or check System Information for wireless card presence.	Yes	Replace wireless card. Verify issue resolved.	N18	WIRELESS DEVICE
	Are both Wi-Fi and Bluetooth services detected in MRI or System Information?	No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	Determine whether issue is related to Bluetooth or Wi-Fi functionality.	Bluetooth	Go to “Bluetooth Device Connection Issues” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Is issue related to Bluetooth or Wi-Fi functionality?	Wi-Fi	Replace logic board. Reinstall user’s wireless card. Verify issue resolved.	M35	MLB

	Check	Result	Action	Code	Commodity
8.	<ul style="list-style-type: none"> • Verify that Wi-Fi network service appears in System Information and can be enabled in System Preferences > Network. • Verify that Bluetooth network interface appears in System Information and can be enabled in System Preferences > Bluetooth. • Connect to a known-good wireless network, and retest data throughput, checking for adequate transfer speeds. • Verify that wireless connection is sustained for several minutes. • Pair with a known-good Bluetooth peripheral. Verify that connection remains functional for several minutes. <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	N99	

Backlight Issue / No Backlight

Unlikely causes:

AirPort/Bluetooth card, AirPort antenna(s), battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, hard disk drive (HDD), HDD data or power or combo cable, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Display not illuminated• Flickering, unstable, or non-uniform backlight• Poor backlight at some or all settings• Display backlight fails after warmup• Display backlight fails at certain brightness settings• Unit appears to turn on and operate, but no image is seen on the display <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.2. Cover ambient light sensor to mimic a dark room and adjust brightness to maximum setting using F2 key on wired keyboard.3. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.4. Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.5. Put the computer to sleep by pressing Control-Shift-Eject. Wake it by pressing any key. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a compatible external display. Check to see whether the external display mirrors the backlight issue or shows any video at all. Does the external display show a video signal of any kind?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	Check Mac Resource Inspector (MRI) results to verify that the display panel is detected. You can use Gateway Manager to access log files on the Apple Service Toolkit (AST) server if there is no video image. Consult the AST Reference Guide for more information on using Gateway Manager. If MRI is not available, use System Information to verify that Color LCD appears in the Display device tree.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
3.	Shine bright (low-heat) flashlight onto front of display panel. With computer turned on, verify whether a faint image is visible.	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
4.	<p>Important: Ensure that user’s computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect display power cable and its connectors between logic board and display panel.</p> <p>Is the cable damaged?</p>	Yes	Replace the display panel, which includes the display power cable. Verify issue resolved.	L09	LCD
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Reseat display power cable between logic board and display panel. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>CAUTION: Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>Is normal video restored?</p>	Yes	Issue resolved by reseating display power cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
6.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 8.	\${nodeText.noSymptomCode}	
8.	<p>Test the logic board display backlight fuse with a multimeter. For information about using a multimeter, see article HT3250: Diagnostics: Using a digital multimeter.</p> <p>Locate fuse F8100 on the logic board. Be careful not to scratch or knock nearby components off the logic board when using the multimeter probes.</p> <p>Set the multimeter to measure ohms (Ω). Place the multimeter probes on each side of the fuse that is soldered to the logic board. The multimeter should measure between zero and one ohm.</p> <p>Refer to the service guide Functional Overview for information about locating fuse F8100.</p> <p>Does the multimeter show a reading greater than 1 Ω?</p>	Yes	Replace logic board. Verify issue resolved.	M25	MLB
		No	Go to step 9.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
9.	Reseat the DisplayPort cable between display panel and logic board. CAUTION: Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Is normal video restored?	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing. Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables. Do you have immediate access to a known-good DisplayPort cable?	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
11.	Important: Ensure that user's computer is shut down, then remove the power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Substitute a known-good DisplayPort cable or use the DisplayPort substitution cable found in the extension cable kit in place of suspect DisplayPort cable. Is normal video restored?	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	To troubleshoot this issue completely, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Replace display panel. Verify issue resolved.	L09	LCD

	Check	Result	Action	Code	Commodity
13.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L09	LCD
		No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	<p>To troubleshoot this issue completely, a known-good logic board is required.</p> <p>Do you have immediate access to a known-good logic board?</p>	Yes	Go to step 15.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M25	MLB
15.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good logic board.</p> <p>Is normal video restored?</p>	Yes	Replace logic board. Verify issue resolved.	M25	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
16.	<p>Restart the computer and verify that the display backlight is fully functional.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\$(nodeText.noSymptomCode)	

Display Anomalies

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Distorted or blurred image • Pixel anomalies • Vertical/horizontal lines • Unstable flickering • Incorrect or missing colors • Nonuniform brightness at specific location • Vertical lines of nonuniform brightness repeating over the display • Image persistence or image sticking on screen • Light leakage around the display <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>References to the “Test Patterns Tool (TPT)” diagnostic in this procedure are intended for all iMacs introduced before 2014, that are supported by AST 1. For iMacs introduced in 2014 and later, use the “Display Anomalies” diagnostic that is supported by AST 2.</p> <p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none"> 1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery. 2. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following articles: <ul style="list-style-type: none"> • HT201177: Get help with video issues on external displays connected to your Mac • HT201261: Intel-based iMac: Available updates 3. Verify that System Preferences > Accessibility > Display > Display Contrast is set to Normal. 4. Check System Preferences > Displays > Color for possible use of a custom display profile. Ensure profile is set to “iMac.” 5. Check the brightness setting. 6. Clean the display and check for dust or debris. 7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 8. Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.	Yes	Go to "Unstable Flickering" troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Of the eight issues below, determine if "unstable flickering" best describes the primary symptom: <ul style="list-style-type: none"> • Unstable flickering • Distorted/blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen 	No	Go to step 2.	`\${nodeText.noSymptomCode}`	
	Is unstable flickering the primary display issue?				
2.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
	Of the seven issues below, determine if "distorted/blurred image" or "unstable flickering" best describes the primary symptom: <ul style="list-style-type: none"> • Distorted/blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen 	No	Go to step 15.	`\${nodeText.noSymptomCode}`	
	Is a distorted or blurred image the primary display issue?				
3.	Connect a compatible external display.	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
	Does image on external display appear distorted and/or blurred?	No	Go to step 9.	`\${nodeText.noSymptomCode}`	
4.	A distorted or blurred image may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.	Before	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	After	Go to step 5.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	Start the computer in Safe Mode.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	To start up into Safe Mode, follow steps listed in HT201262: Use safe mode to isolate issues with your Mac .	No	Go to step 6.	`\${nodeText.noSymptomCode}`	
	Does issue still occur in Safe Mode?				
6.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Are you able to remove RAM modules?	No	Go to step 9.	`\${nodeText.noSymptomCode}`	
7.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of display panel and logic board to access the memory modules.	Yes	Replace memory module(s). Note: Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	Note: Be sure to always have at least the minimum amount of memory installed to support the computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1 GB module with a known-good 2 GB module to support starting into macOS.	No	Go to step 8	`\${nodeText.noSymptomCode}`	
	Does issue occur only with specific memory module(s)?				
8.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on logic board?	No	Go to step 9.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
10.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
11.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 13.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	To completely troubleshoot this issue, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L04	LCD
14.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel to test logic board video output.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L04	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
15.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the six issues below, determine if "vertical/horizontal lines" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Are vertical or horizontal lines the primary display issue?</p>	Yes	Go to step 16.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 29.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
16.	Connect an external compatible display.	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
	Are vertical and/or horizontal lines present on external display?	No	Go to step 22.	`\${nodeText.noSymptomCode}`	
17.	Vertical and/or horizontal lines may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.	Before	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	After	Go to step 18.	`\${nodeText.noSymptomCode}`	
18.	Start the computer in Safe Mode.	Yes	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	To start up into Safe Mode, follow steps listed in HT201262: Use safe mode to isolate issues with your Mac . Does issue still occur in Safe Mode?	No	Go to step 19.	`\${nodeText.noSymptomCode}`	
19.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.	Yes	Go to step 20.	`\${nodeText.yesSymptomCode}`	
	Are you able to remove RAM modules?	No	Go to step 22.	`\${nodeText.noSymptomCode}`	
20.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of display panel and logic board to access the memory modules. Note: Be sure to always have at least the minimum amount of memory installed to support computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1GB module with a known-good 2GB module to support starting into macOS.	Yes	Replace memory module(s). Note: Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	Does issue occur only with specific memory module(s)?	No	Go to step 21.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
21.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on the logic board?	No	Go to step 22.	\$(nodeText.noSymptomCode)	
22.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins. Is DisplayPort cable or its connector damaged?	No	Go to step 25.	\$(nodeText.noSymptomCode)	
23.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 24.	\$(nodeText.yesSymptomCode)	
	Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables. Do you have immediate access to a known-good DisplayPort cable?	No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
24.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable. Is normal video restored?	No	Go to step 25.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
25.	Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	Is logic board cable connector damaged?	No	Go to step 26.	\$(nodeText.noSymptomCode}	
26.	To troubleshoot this issue completely, a known-good display panel is required.	Yes	Go to step 27.	\$(nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good display panel?	No	Go to step 28.	\$(nodeText.noSymptomCode}	
27.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 28.	\$(nodeText.yesSymptomCode}	
	Substitute a known-good display panel to test logic board video output. Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips, refer to articles: <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety 	No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
	Is normal video restored?				
28.	Examine image on display and determine whether lines are vertical or horizontal.	Vertical	Replace display panel. Verify issue resolved.	L27	LCD
	Are lines vertical or horizontal?	Horizontal	Replace display panel. Verify issue resolved.	L26	LCD

	Check	Result	Action	Code	Commodity
29.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the five issues below, determine if "pixel anomalies" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Are vertical or horizontal lines the primary display issue?</p>	Yes	Go to step 30.	\${nodeText.yesSymptomCode}	
		No	Go to step 32.	\${nodeText.noSymptomCode}	
30.	<p>Inspect display closely and determine whether pixel "anomalies" are actually dust or debris on surface of display panel.</p> <p>Are anomalies caused by dust, debris, or other surface contamination?</p>	Yes	Clean display panel if possible. Verify issue resolved.	\${nodeText.yesSymptomCode}	
		No	Go to step 31.	\${nodeText.noSymptomCode}	
31.	<p>Refer to article HT202025: About LCD display pixel anomalies for Apple products released in 2010 and later to determine whether number of anomalies exceeds specification. Determine whether number of bright or dark pixel anomalies (or a combination of these) exceed specification.</p> <p>Does the number of pixel anomalies exceed the specified limit?</p>	Yes	Replace display panel. Verify issue resolved.	L20	LCD
		No	Explain to user that display is within specifications. Do not replace display panel. Verify resolution.	\${nodeText.noSymptomCode}	
32.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the four issues below, determine if "nonuniform brightness" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is nonuniform brightness the primary display issue?</p>	Yes	Go to step 33.	\${nodeText.yesSymptomCode}	
		No	Go to step 37.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
33.	<p>Determine whether variation in uniformity appears excessive when compared to a known-good similar computer.</p> <p>Does nonuniform brightness exceed that of a known-good computer?</p>	Yes	Go to step 34.	\$(nodeText.yesSymptomCode)	
		No	Display panel seems to be within specifications. Do not replace display panel. Verify resolution.	\$(nodeText.noSymptomCode)	
34.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove display panel. Inspect for mechanical interference from screws or cables making contact with back of display panel. Reseat components and cables.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is resealed to these surfaces.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating internal components. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 35.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
35.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect and reseal backlight cable.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Issue resolved by reseating backlight cables. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 36.	`\${nodeText.noSymptomCode}`	
36.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board. Reconnect all internal cables and reinstall display panel. Retest.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L21	LCD

	Check	Result	Action	Code	Commodity
37.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the three issues below, determine if "incorrect or missing colors" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is incorrect or missing colors the primary display issue?</p>	Yes	Go to step 38.	\$(nodeText.yesSymptomCode)	
		No	Go to step 46.	\$(nodeText.noSymptomCode)	
38.	<p>Verify that display is listed in System Information > Hardware > Graphics/Displays > Video Card. This ensures that color profile can be matched with display panel.</p> <p>Is display hardware detected?</p>	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
		No	Go to step 40.	\$(nodeText.noSymptomCode)	
39.	<p>Go to System Preferences > Displays > Color to make sure "iMac" is selected under Display profile. Inspect display again for incorrect or missing colors.</p> <p>Are colors still incorrect or missing when display profile is set to "iMac"?</p>	Yes	Go to step 40.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved by setting a valid display profile. User may have created an off-color calibration setting. Verify resolution.	\$(nodeText.noSymptomCode)	
40.	<p>Run Mac Resource Inspector (MRI) to check for display panel presence.</p> <p>Is display panel detected (green) in MRI?</p>	Yes	Go to step 42.	\$(nodeText.yesSymptomCode)	
		No	Go to step 41.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
41.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board and retest.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 42.	`\${nodeText.noSymptomCode}`	
42.	<p>Launch the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the Solid Gray Light display test pattern.</p> <p>Verify whether incorrect/missing color issue affects entire screen.</p> <p>Is entire screen affected?</p>	Yes	Go to step 44.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 43.	`\${nodeText.noSymptomCode}`	
43.	<p>Put computer side-by-side with a known-good equivalent iMac display showing same Solid Gray Light image.</p> <p>Is issue noticeably worse on the user's display?</p>	Yes	Go to step 44.	`\${nodeText.yesSymptomCode}`	
		No	Small variations in color uniformity are normal and do not warrant replacement of display.	`\${nodeText.noSymptomCode}`	
44.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 45.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L02	LCD

	Check	Result	Action	Code	Commodity
45.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel to test logic board video output.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L02	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
46.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the two issues below, determine if "light leakage around the display" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Light leakage around the display • Image persistence or image sticking on screen <p>Is light leakage around display edges the primary display issue?</p>	Yes	Go to step 47.	\${nodeText.yesSymptomCode}	
		No	Go to step 50.	\${nodeText.noSymptomCode}	
47.	<p>Launch the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the All Black display test pattern.</p> <p>It is very important that you verify this issue using ONLY an all black display test pattern with no other images present such as icons, dock, and so on.</p> <p>Adjust display position and brightness to normal settings.</p> <p>Dim lights so you can more clearly see any light leakage around edges of the display panel.</p> <p>Is any noticeable light leakage present around edges of the display?</p>	Yes	Go to step 48.	\${nodeText.yesSymptomCode}	
		No	Explain to user that display is within specifications. Do not replace display panel. Verify resolution.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
48.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Carefully disconnect and remove display panel.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is reseated to these surfaces.</p>	Yes	Replace chin strap. Reinstall user's display panel. Verify issue resolved.	X13	PIECE PART
	<p>Remove and closely inspect chin strap for any damage, bowing, or bending.</p> <p>Verify that all cushioned pads are securely installed on each end of the chin strap and are not damaged, torn, out of place, or missing. These pads are part of the chin strap.</p> <p>Does chin strap appear damaged, bent, or bowed?</p>	No	Go to step 49.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
49.	Recheck that previous disassembly was performed properly using proper tools and techniques and not by simply pulling display off. Incorrect removal technique can damage or bow chin strap, causing light leakage in lower display area.	Yes	Replace display panel. Verify issue resolved.	L28	LCD
	<p>Reinstall chin strap, being very careful to not damage, bow, or otherwise bend chin strap during installation.</p> <p>Reapply new foam tape gaskets for all four display sides, being very careful to apply the tape smoothly around entire edge.</p> <p>Reinstall display panel, being careful when seating edges of display against foam-backed tape around edges to ensure a smooth, complete seal around entire perimeter.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Retest using the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the All Black display test pattern.</p> <p>Is any noticeable light leakage still present around edges of display?</p>	No	Issue resolved by reseating display and chin strap. Verify issue resolution.	\$(nodeText.noSymptomCode)	
50.	A display might show a temporary faint remnant of a previous image even after a new image replaces it. Follow instructions using procedure listed for this computer in article TP949: Image Persistence Test to determine if display fails or passes the Image Persistence Test.	Yes	Replace display panel. Verify issue resolved.	L25	LCD
	Does the display fail the Image Persistence Test?	No	The display is within specification. Do not replace display panel.	\$(nodeText.noSymptomCode)	
51.	Verify that display issue or anomaly has been resolved.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Power But Blank/No Video

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Power available, but no video visible on display.Fan or hard drive spinning sounds are audible.Caps Lock key LED illuminates when pressed. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Press F2 key to increase screen brightness.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Disconnect all peripherals.Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac .	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
	Start up computer using known-good up-to-date, bootable macOS volume.				
	Look and listen for any evidence that the computer is starting up. Be aware that some iMacs do not emit a startup sound.	No	Go to step 2.	`\${nodeText.noSymptomCode}`	
	Is there any evidence that the computer is starting up?				

	Check	Result	Action	Code	Commodity
2.	While starting up from known-good up-to-date, bootable macOS volume, check whether computer has a memory error (a series of beep tones during startup). Does computer make error tones during startup?	Yes	Go to “Will Not Start Up” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	Determine whether issue is no backlight or no image: <ul style="list-style-type: none"> Image with no backlight can be seen by shining a low-heat light source onto the built-in display during or after startup. No image can be identified by a blank display with or without backlight or a solid color on the built-in display. Is the issue no backlight or no image?	No Backlight	Go to “Backlight Issue / No Backlight” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No Image	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Connect a known-good external display and press power button. Hold down Command-R during startup to restart from the recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display. Is correct image visible on external display?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 11.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
	<p>Use one of the methods below to determine whether the user's computer recognizes its built-in display panel.</p> <p>METHOD 1: Review MRI results or System Information > Graphics/Displays. Look for information indicating internal display presence in results.</p> <p>METHOD 2: Remove display panel.</p> <p>Connect AC power cord to computer and plug into mains. Locate diagnostic LEDs on logic board. Connect a known-good external display and press power button. During startup, computer should communicate with video controller and light diagnostic LED #4 to indicate an active display.</p> <p>Note: LED #4 may not light with display panel removed.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is built-in display panel detected?</p>	No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	Inspect DisplayPort cable and connectors for damage. Also inspect connectors on display panel and logic board.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Did you find any damaged components?	No	Go to step 8.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	<p>Damage to multiple parts requires an escalation to ACS for approval for repair.</p> <p>Is damage limited to DisplayPort cable only?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	
8.	<p>Test the logic board display power fuse with a multimeter. For information about using a multimeter, see article HT3250: Diagnostics: Using a digital multimeter.</p> <p>Locate fuse F4400 on the logic board. Be careful not to scratch or knock nearby components off the logic board when using the multimeter probes.</p> <p>Set the multimeter to measure ohms (Ω). Place the multimeter probes on each side of the fuse that is soldered to the logic board. The multimeter should measure between zero and one ohm.</p> <p>Refer to the service guide Functional Overview for information about locating fuse F4400.</p> <p>Does the multimeter show a reading greater than 1 Ω?</p>	Yes	Replace logic board. Verify issue resolved.	M03	MLB
		No	Go to step 9.	\${nodeText.noSymptomCode}	
9.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 10.	\${nodeText.yesSymptomCode}	
		No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
10.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>If any known-good cables are still installed from previous steps, continue using known-good cables to help find faulty module.</p> <p>Does display present video with or without backlight?</p>	With Backlight	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No Backlight	Replace the display panel. Verify issue resolved.	L03	LCD
11.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Remove display panel.</p> <p>Locate diagnostic LEDs on logic board. Connect AC power cord and press power button, diagnostic LEDs #1 and #2 should be on. This indicates power to computer.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Are diagnostic LEDs #1 and #2 on?</p>	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
		No	Go to "No Power" troubleshooting flow.	\${nodeText.noSymptomCode}	
12.	<p>Disconnect DisplayPort cable from logic board. Connect a known-good external display and press power button. Hold down Command-R during startup to restart from recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display.</p> <p>Is correct image visible on external display?</p>	Yes	Replace display panel. Verify issue resolved.	L03	LCD
		No	Replace logic board. Verify issue resolved.	M03	MLB

	Check	Result	Action	Code	Commodity
13.	Restart the computer and verify that the video is fully functional. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	

Unstable Flickering

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, hard disk drive (HDD), hard drive data or power or combo cable, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Flickering video image• Flickering backlight• Dock and/or menu bar position not stable• Display intermittently flashes on/off• Unstable image <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.2. Check the brightness setting.3. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following articles:<ul style="list-style-type: none">• HT201177: Get help with video issues on external displays connected to your Mac• HT201261: Intel-based iMac: Available updates4. Clean display and check for dust or debris.5. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.6. Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Adjust built-in display brightness setting to low backlight level, just above off.	Backlight	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	<p>Verify whether user issue is due to backlight flickering or to an unstable or flickering video image on display.</p> <p>You may need to shine a bright (low heat) flashlight onto front of display panel with computer turned ON to verify whether a faint video image is occasionally visible through the flickering.</p> <p>Note: If video is present but backlight never turns on, exit this procedure and go to the “Backlight Issue / No Backlight” troubleshooting flow instead. Use this procedure only for flickering backlight or video image.</p> <p>Which is flickering, backlight or video?</p>	Video	Go to step 8.	`\${nodeText.noSymptomCode}`	
2.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect display power cable and its connectors between logic board and display panel.</p> <p>Is display power cable damaged?</p>	Yes	Replace display panel, which includes display power cable. Verify issue resolved.	L06	LCD
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
3.	Reseat display power cable between logic board and display panel. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating display power cable. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
	<p>Warning: Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	To troubleshoot this issue completely, a known-good display panel is required.	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good display panel?	No	Replace display panel. Verify issue resolved.	L06	LCD
5.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L06	LCD
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	To troubleshoot this issue completely, a known-good power supply is required.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good power supply?	No	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY

	Check	Result	Action	Code	Commodity
7.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good power supply.</p> <p>Is normal video restored?</p>	Yes	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Reseat DisplayPort cable between LCD panel and logic board. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
	Warning: Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.				
	For additional safety information and tips, refer to articles: <ul style="list-style-type: none"> TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety TP1637: iMac Pro (2017): Safety 	No	Go to step 11.	\$(nodeText.noSymptomCode)	
	Is normal video restored?				
11.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
	Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.	No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Do you have immediate access to a known-good DisplayPort cable?				
12.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.	No	Go to step 13.	\$(nodeText.noSymptomCode)	
	Is normal video restored?				

	Check	Result	Action	Code	Commodity
13.	To troubleshoot this issue completely, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L06	LCD
14.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Substitute a known-good display panel. Is normal video restored?	Yes	Replace display panel. Verify issue resolved.	L06	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M29	MLB
15.	Confirm that the computer display flickering or unstable video issue is resolved. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	

Audio-in Jack Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">External audio-in port does not work with an analog or digital line-level source <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Use controls to adjust sound volume and ensure that audio output is not muted.Ask user which type of audio input cable is connected to the computer's audio-in jack: analog or optical cable. <p>Important: Some iMac models do not support optical audio. Refer to Apple product specifications for more information.</p> <ol style="list-style-type: none">Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Check that a known-good audio cable is used with the analog 3.5 mm stereo mini plug end connected to the proper input on the computer and the other end connected to a compatible line-level audio source.Check that a known-good analog audio device (such as an iPod, iPhone, or Mac) is used as a source and is playing audio.On the user's computer, go to System Preferences > Sound and verify the following:<ul style="list-style-type: none">Input tab:<ul style="list-style-type: none">"Line In" input source is available and selected when an analog audio source is connected."Input volume" slider is not set to zero (available only with an analog audio input).Output tab:<ul style="list-style-type: none">Sound output device is set to Internal Speakers.Output volume is not muted or set to zero.Open QuickTime Player. Choose "New Audio Recording" from File menu. Choose "Built-in Input: Line In" input source from right pop-up menu and adjust sound volume using slider in center of window.If audio is heard, then verify user's cable and audio device using same process. <p>Note: Disconnecting an analog stereo mini plug cable from the iPod/iPhone side will pause audio playback.</p> <ol style="list-style-type: none">Perform visual and mechanical inspection of audio input and output jacks. Use an otoscope to inspect for dust and/or debris. Use compressed air to clean and remove any dust and/or debris.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p>

	<p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety
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Deep Dive

	Check	Result	Action	Code	Commodity
1.	Play a known-good audio file or reliable Internet radio station via iTunes. Verify that sound is clearly audible and free of distortion through both headphones and internal speakers. Does the audio file play correctly?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Specify whether playback from known-good audio source is distorted or not audible.	Distorted	Go to “Distorted Audio from Internal Speaker(s)” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Is sound distorted or not audible?	Not Audible	Go to “No Audio from Internal Speaker(s) or Headphone Jack” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
3.	Hold down Command-R during startup to restart from recovery partition, and try to reproduce audio input issue using known-good audio sources and cables. Does audio issue persist with known-good OS?	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.noSymptomCode}`	
4.	From user information, identify whether analog line-in or optical digital-in is causing issue.	Analog Line-in	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Some iMac models do not support optical audio. Refer to Apple product specifications for more information. Which audio input is affected: analog line-in or optical digital-in?	Optical Digital-in	Go to step 10.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	<p>To troubleshoot this issue completely, a known-good 3.5 mm stereo cable is required.</p> <p>Do you have immediate access to a known-good 3.5 mm stereo cable?</p>	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Computer analog input cannot be tested without an adequate 3.5 mm male-to-male stereo mini plug cable.</p>	`\${nodeText.noSymptomCode}`	
6.	<p>Disconnect any cable from audio in (mic) port to verify default setting for audio in.</p> <p>In System Preferences > Sound > Input, verify that the Line In audio input source is listed and that the Input volume slider is present.</p> <p>Set Input volume to middle position.</p> <p>Is Line In audio input available?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	<p>Line in activity appears to be stuck to optical digital-in mode:</p> <ul style="list-style-type: none"> • Insert a 3.5 mm stereo mini plug into the audio in port and then rapidly unplug it and plug it in several times to reset internal switches in the connector. • Verify whether System Preferences > Sound > Input reverts to Line In after plug insertion and removal. • Close and reopen Sound Preferences window to refresh list of current audio input sources. <p>Does audio input in System Preferences revert to Line In after minijack insertion and removal?</p>	Yes	Issue resolved by resetting audio-in jack. To prevent the issue from recurring suggest that user check physical specifications of cable connectors previously connected to this jack.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
8.	Play a known-good audio file or Internet radio station in iTunes, and verify that it plays through internal speakers.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	<p>Connect 3.5 mm male-to-male stereo mini plug cable between the audio in (mic) port and the audio out (headphone) port.</p> <p>In System Preferences > Sound > Output verify that Headphones audio output source appears and select it.</p> <p>In System Preferences > Sound > Input, select Line In, then adjust the Input volume slider to observe activity level without peaking at maximum.</p> <p>Does the bar graph at bottom of recording window show input activity?</p>	No	Go to step 14.	`\${nodeText.noSymptomCode}`	
9.	Open QuickTime Player and choose New Audio Recording from File menu.	Yes	Computer analog audio input appears to be performing to specifications. Verify issue resolved.	`\${nodeText.yesSymptomCode}`	
	<p>In the new recording window, choose "Built-In: Line Input" source from input source right pop-up menu. Adjust volume using slider in center of window.</p> <p>Press record button to start recording. Record for several seconds, then click record button again to stop recording.</p> <p>Disconnect stereo cable from audio out (headphone) port to hear audio through internal speakers. If needed, press F11-F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio file or Internet radio.</p> <p>Play recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
10.	<p>To troubleshoot this issue completely, a known-good 3.5 mm mini-TOSLINK optical cable is required.</p> <p>Do you have immediate access to a known-good 3.5 mm mini-TOSLINK cable?</p>	Yes	Go to step 11.	#{nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Computer digital input cannot be tested without adequate 3.5 mm mini-TOSLINK male-to-male optical cable.	#{nodeText.noSymptomCode}	
11.	<p>Connect 3.5 mm mini-TOSLINK cable to the audio out (headphone) port.</p> <p>In System Preferences > Sound > Output, verify that a Digital Out audio output source appears, and select it.</p> <p>Play a known-good audio file or Internet radio station.</p> <p>Audio out should switch to optical digital audio, and unplugged end of cable will emit a red light to indicate transmission of a digital audio stream.</p> <p>Is red light visible at unplugged end of mini-TOSLINK cable?</p>	Yes	Go to step 12.	#{nodeText.yesSymptomCode}	
		No	Go to step 14.	#{nodeText.noSymptomCode}	
12.	<p>Continue to play known-good audio.</p> <p>Connect other end of 3.5 mm mini-TOSLINK cable to audio in (mic) port.</p> <p>Open QuickTime Player and choose New Audio Recording from File menu.</p> <p>In the new recording window, choose "Built-in Input: Digital In" from the input source pop-up menu, and adjust volume using slider in center of window.</p> <p>Does the bar graph at bottom of the recording window show input activity?</p>	Yes	Go to step 13.	#{nodeText.yesSymptomCode}	
		No	Go to step 14.	#{nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
13.	Press record button to start recording. Record for several seconds. Press record button again to stop recording.	Yes	Computer digital audio input appears to be performing to specifications. Verify issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Disconnect optical cable from audio out (headphone) port to hear audio through internal speakers. Press F11 and F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio.</p> <p>Play the recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.	\${nodeText.noSymptomCode}	
14.	Disconnect cable from audio in (mic). Open QuickTime Player and choose New Audio Recording from the File menu. Choose "Built-in Microphone: Internal Microphone" from the pop-up menu to record from an internal microphone input source. Compare distortion between recorded internal input and external input sources.	Yes	Replace logic board. Verify issue resolved.	M09	MLB
	<p>Is recorded sound also distorted when recorded from internal microphone input?</p>	No	Go to step 15.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
15.	Disconnect headphones or external speakers.	Yes	Issue resolved by reseating audio cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable connector and its corresponding connector on logic board. Reseat connection and retest.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is recorded sound audible, clear, and free of distortion?</p>	No	Go to step 16.	`\${nodeText.noSymptomCode}`	
16.	<p>To troubleshoot this issue completely, a known-good rear enclosure is required.</p> <p>Do you have immediate access to a known-good rear enclosure?</p>	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99	

	Check	Result	Action	Code	Commodity
17.	<p>Substitute a known-good rear enclosure with audio ports and retest recording.</p> <p>To do this, carefully place known-good rear enclosure near the user's computer, then temporarily plug audio flex cable from known-good rear enclosure into audio connector on the logic board inside user's computer.</p> <p>Is recorded sound audible, clear, and free of distortion?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99	
		No	Replace logic board. Verify issue resolved.	M09	MLB
18.	<p>Plug a known-good analog audio source into audio in jack, and verify that sound recorded is audible and free of distortion.</p> <p>Repeat with digital (optical) audio source (for models that support digital optical audio only).</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	<p> <code> \${nodeText.yesSymptomCode} </code> </p>	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Camera Issues

Unlikely causes:

Battery, CPU fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Camera not detected• No green LED for camera• Excessive blooming• Poor white balance• Poor focus• Green image• Image distortion <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.2. Verify that the camera lens and display bezel are clean and clear of contaminants.3. Verify that another application is not using the camera. Refer to HT201715: "Your camera is in use by another application" message.4. Ask user about lighting conditions in his or her working environment. Dim lighting causes poor image quality. Overly bright lighting can bounce off surfaces onto subject and make image foggy.5. Striped, textured, and mesh clothing can create moiré patterns in image.6. Reset SMC using procedure for this computer in article HT201295: Intel-based Macs: Resetting the System Management Controller (SMC).7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.8. Disconnect all peripheral devices and restart computer. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Check Mac Resource Inspector (MRI) results to verify that the camera is detected.</p> <p>If AST 1 or AST 2 is not available, use System Information to verify that the FaceTime HD Camera is recognized.</p> <p>Depending on computer model, the camera will be listed in System Information > Hardware > USB or Camera Device Tree. Verify that "FaceTime HD Camera (Internal)" is listed.</p> <p>Does MRI or System Information detect the camera?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
2.	<p>Launch Photo Booth. Verify that the green LED next to the camera illuminates when an image is present in Photo Booth.</p> <p>Does the camera LED light up?</p>	Yes	Go to step 4	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers.</p> <p>Retest the camera.</p> <p>Does the camera function properly in a known-good OS?</p>	Yes	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
4.	<p>Verify that the camera image is clear and undistorted.</p> <p>Is the image clear?</p>	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	<p>Check camera/microphone/ALS Cable or camera cable connection to camera and to logic board. Check cable connectors to camera and logic board for loose or broken wires or pins.</p> <p>Does camera cable show any signs of damage?</p>	Yes	<p>Replace camera/microphone/ALS Cable or camera cable (depending on model).</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
6.	Inspect camera/microphone/ALS Cable or camera cable connectors on logic board, looking for a missing connector, cracking housing, or bent or broken pins that may have lifted from logic board solder pads. Does logic board connector show any signs of damage?	Yes	Replace the logic board. Verify issue resolved.	M13	MLB
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	Reseat camera cable securely to logic board. Check System Information again. Does camera appear in System Information?	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 9.	`\${nodeText.noSymptomCode}`	
8.	Launch Photo Booth. Verify that green LED next to camera lights up. Make sure image looks normal. Does camera LED light up and image appear normal?	Yes	Issue resolved by reseating the camera cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 11.	`\${nodeText.noSymptomCode}`	
9.	To troubleshoot this issue completely, a known-good camera/microphone/ALS Cable or camera cable (depending on model) is required. Do you have immediate access to a known-good camera cable?	Yes	Go to step 10.	`\${nodeText.yesSymptomCode}`	
		No	Replace camera/microphone/ALS Cable or camera cable (depending on model). Verify that the issue is resolved.	X03	INTERNAL CABLE
10.	Substitute a known-good camera/microphone/ALS Cable or camera cable (depending on model) and retest. Is camera working normally?	Yes	Replace camera/microphone/ALS Cable or camera cable (depending on model). Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	Go to step 11.	`\${nodeText.noSymptomCode}`	
11.	To troubleshoot this issue completely, a known-good camera is required. Do you have immediate access to a known-good camera?	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	Replace camera. Verify issue resolved.	X21	OTHER ELECTRIC
12.	Substitute a known-good camera and retest. Is camera working normally?	Yes	Replace camera. Verify issue resolved.	X21	OTHER ELECTRIC
		No	Go to step 13.	`\${nodeText.noSymptomCode}`	
13.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Verify issue resolved.	M13	MLB

	Check	Result	Action	Code	Commodity
14.	Substitute a known-good logic board and retest. Is camera working normally?	Yes	Replace logic board. Verify issue resolved.	M13	MLB
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
15.	Confirm that the computer's FaceTime camera is recognized and functional. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

Distorted Audio from Internal Speaker(s)

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, flash storage card/solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, display panel, memory, power supply, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Sound is distorted, fuzzy, or crackly.• Symptom only appears in internal speaker.• Symptom also appears in external speakers/headphones. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test with a known-good stereo sound file.2. Compare the same sound and settings against a known-good similar model computer to make sure sound is indeed distorting.3. In System Preferences > Sound > Output, adjust the Output volume and use Balance slider to isolate left and right speakers. Check whether issue only happens with one speaker.4. If testing with iTunes, make sure both equalizer and preamp settings are set to Flat.5. Test audio output using more than one application or website.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version.</p> <p>Does the audio issue persist from a known-good OS?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	<p>Play known-good audio file on internal speakers, then connect known-good headphones or external speakers and compare for distortion.</p> <p>Is sound also distorted through headphones or external speakers?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable to audio I/O ports and its corresponding connection on logic board.</p> <p>Did you find damage to audio cable or logic board connector?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
4.	<p>Determine whether damage is on the logic board, audio cable, or both.</p> <p>Is the damage limited to logic board?</p>	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good logic board?	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
6.	Substitute known-good logic board and retest. Is sound through headphones or external speakers audible, clear, and free of distortion?	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\${nodeText.noSymptomCode}	
7.	Run AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
	Refer to article TP587: Using Audio Test .				
	Does unit pass Audio Test?	No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate speaker connections on logic board. Disconnect and inspect both speaker cable connectors and corresponding connectors on logic board for damage.</p> <p>Reconnect the left and right speakers to the logic board, verifying that the connections are all seated properly.</p> <p>Did you find damage to speakers or logic board connector?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 10.	\${nodeText.noSymptomCode}	
9.	<p>Determine whether damage is on the logic board, speakers, or both.</p> <p>Is the damage limited to speaker(s)?</p>	Yes	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
10.	With speaker connectors reseated to logic board, verify you can hear audio through internal speakers.	Yes	The issue was resolved by reseating cables. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>In System Preferences > Sound > Output tab, adjust Balance slider to check left and right speaker channel separation.</p> <p>Play music with high and low tones to check bass and tweeter performance of left and right speakers.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is sound from affected speaker audible, clear, and free of distortion?</p>	No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Inspect and carefully clean affected speaker cone using a soft tissue to remove dust, debris, or foreign material such as metal fragments that easily adhere to the magnetic speaker. Reseat speaker connection and retest.	Yes	Issue resolved by cleaning the speaker membrane. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Is sound from affected speaker audible, clear, and free of distortion?</p>	No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	To troubleshoot this issue completely, a known-good internal speaker set is required.	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
	<p>Internal speakers are specified to work as a matched pair and must be tested or replaced as matched pairs.</p> <p>Keep and identify your known-good speakers from one kit as a matched pair.</p> <p>Do you have immediate access to a known-good speaker set?</p>	No	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X09	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
13.	Substitute a known-good internal speaker set and verify you can hear audio through internal speakers.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.	X09	OTHER ELECTRIC
	Retest using AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.		Verify that the issue is resolved.		
	Refer to article TP587: Using Audio Test . Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
14.	Does unit pass Audio Test?				
	Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the issue resolved?				

External Apple Bluetooth Peripherals

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> Apple Bluetooth wireless keyboard, mouse, or trackpad is not recognized by known-good computer Apple Bluetooth wireless keyboard, mouse, or trackpad will not pair with known-good computer Apple Bluetooth wireless keyboard, mouse, or trackpad intermittently loses its connection Apple wireless keyboard has one or more of the following issues: <ul style="list-style-type: none"> No power Battery will not charge (for peripherals with embedded batteries) Swollen battery (for peripherals with embedded batteries) Battery runtime too short Will not turn off One or more keys do not work Keys seem to stick, do not respond properly, or respond slowly Wrong keyboard language Keys missing or falling off Paint wearing off of one or more keys Physical and/or cosmetic issues Apple wireless mouse has one or more of the following issues: <ul style="list-style-type: none"> No power Battery will not charge (for peripherals with embedded batteries) Swollen battery (for peripherals with embedded batteries) Battery runtime too short Will not turn off No mouse response Mouse click not recognized Mouse causes erratic cursor tracking Physical and/or cosmetic issues Apple wireless trackpad has one or more of the following issues: <ul style="list-style-type: none"> No power Battery will not charge (for peripherals with embedded batteries) Swollen battery (for peripherals with embedded batteries) Battery runtime too short Will not turn off No trackpad response Trackpad click not recognized Trackpad causes erratic cursor tracking Trackpad requires high click force Trackpad click overly sensitive Force Touch or haptic feedback issue Physical and/or cosmetic issues <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Important: This troubleshooting procedure is intended only for Apple Bluetooth wireless peripheral devices, such as the following Apple products:</p> <ul style="list-style-type: none"> Magic Mouse or Magic Mouse 2 Magic Trackpad or Magic Trackpad 2 Apple Wireless Keyboard or Magic Keyboard <p>For simplicity, this procedure refers to these products as wireless mouse, wireless trackpad, and wireless keyboard unless otherwise noted.</p> <p>For third-party devices, contact the manufacturer for support, software/firmware updates, or service options.</p> <ol style="list-style-type: none"> Verify compatibility of the user's Apple wireless mouse, keyboard, or trackpad. Refer to HT201806: How to identify your Apple wireless mouse, keyboard, or trackpad. Check for and apply the latest software and firmware updates. In System Preferences, make sure Bluetooth is on and set to Discoverable. For Apple Bluetooth peripherals with replaceable batteries, such as Magic Mouse, Magic Trackpad, or Apple Wireless Keyboard: If the device does not turn on, then install new or fully charged batteries. For Apple Bluetooth peripherals with embedded batteries, such as Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard: If the device does not turn on, then connect a known-good USB Power Adapter and Lightning cable to the device to charge it for at least two minutes. Switching the device on/off button or switch to the on position will allow the device to charge more quickly than when off. For Apple Bluetooth peripherals with embedded batteries such as Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard, verify that the computer being used with the peripheral supports Bluetooth 4.0 or later. Computers with earlier versions of Bluetooth support will not pair with Apple Bluetooth peripherals with embedded batteries. Reset Bluetooth device or delete pairing (if applicable). If Bluetooth pairs normally at your service location, then research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference. Magic Mouse 2, Magic Trackpad 2, and Magic Keyboard can pair with the computer using either Bluetooth or a Lightning cable. If Bluetooth pairing is not possible due to interference or other reasons, then try pairing these products by connecting them to the known-good computer with a known-good Lightning cable. Refer to HT201178: Set up your Apple wireless mouse, keyboard, and trackpad. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work and HT203162: One or more keys on the keyboard do not respond for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's wireless mouse, wireless trackpad, or wireless keyboard for any physical, cosmetic, and liquid damage.</p> <p>On a wireless mouse or wireless trackpad, verify that the mouse or trackpad button clicks.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's wireless mouse, wireless trackpad, or wireless keyboard show signs of damage?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
2.	<p>Determine whether there is a safety issue, such as fumes, excessive heat, or shock.</p> <p>Do not perform procedures that can be a safety risk to you or the user.</p> <p>Can you proceed safely?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support regarding safety procedures for this product.</p>	\$(nodeText.noSymptomCode)	
3.	<p>Isolate damage issue to either user's wireless keyboard or wireless mouse or trackpad.</p> <p>Which peripheral is damaged?</p>	Wireless keyboard	Go to step 4.	\$(nodeText.yesSymptomCode)	
		Wireless mouse or trackpad	Go to step 8.	\$(nodeText.noSymptomCode)	
4.	<p>Closely examine the user's device to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to device.</p> <p>Is damage to user's device related to liquid spill?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K90	KEYBOARD
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Closely examine the user's device for any signs of physical damage that may affect operation.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K16	KEYBOARD
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Closely examine the user's device for signs of paint wearing off of one or more keys.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K35	KEYBOARD
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless keyboard out of warranty.	K21	KEYBOARD
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
8.	Closely examine the user's device to determine exact nature of the issue.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K90	MOUSE
	Look for any signs of liquid spill, liquid penetration, or liquid damage to device.	No	Go to step 9.	\$(nodeText.noSymptomCode)	
	Is damage to user's device related to liquid spill?				
9.	Closely examine the user's device for any signs of physical damage that may affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K16	MOUSE
	Does the user's device exhibit this symptom?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K21	MOUSE
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
11.	Follow steps listed in HT201171: Using a Bluetooth mouse, keyboard, or trackpad with your Mac to pair the user's Bluetooth device with a known-good Mac.	Yes	ESCALATION REQUIRED. The Bluetooth device appears to be performing to specifications. There may be an issue with the user's computer, or wireless interference in user's environment. If issue persists, then contact ACS for additional support.	\$(nodeText.yesSymptomCode)	
	Test the user's wireless mouse, wireless trackpad, or wireless keyboard manually, using built-in applications on a known-good Mac. For example, use the Notes application to check the keys on a wireless keyboard.				
	Refer to HT204621: If your Apple wireless mouse, keyboard, or trackpad aren't working as expected for tips to resolve issues.				
12.	Does the user's wireless mouse, wireless trackpad, or wireless keyboard pair and function normally?	No	Go to step 12.	\$(nodeText.noSymptomCode)	
	Isolate failure to either user's wireless keyboard or wireless mouse or trackpad.	Wireless keyboard	Go to step 13.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless mouse or trackpad	Go to step 29.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	Look for for any signs of power on the user's wireless keyboard, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Verify that the user's wireless keyboard turns ON when the on/off button or switch is placed in the on position. Verify that the user's wireless keyboard turns off when the on/off button or switch is placed in the off position. Does the user's wireless keyboard exhibit any power-related symptoms?	No	Go to step 18.	\${nodeText.noSymptomCode}	
14.	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not functioning at all (seems dead, no power, power LED does not turn on) 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K09	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	Verify that the user's wireless keyboard turns on when the on/off button or switch is placed in the on position. Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> On/off switch or button is defective 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K19	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 16.	\${nodeText.noSymptomCode}	
16.	Verify that the user's wireless keyboard turns off when the on/off button or switch is placed in the off position. Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard remains on when the on/off button or switch has been placed in the off position 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K34	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 17.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
17.	Verify if the user's wireless keyboard has any other power-related issue that is not related to the on/off button or switch.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K20	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Power Issue, not due to on/off button or switch Does the user's wireless keyboard exhibit this symptom?	No	Go to step 18.	`\${nodeText.noSymptomCode}`	
18.	If the user's issue involves pairing or connecting to a Magic Keyboard, then you can connect to, pair, and use this device with the computer using either Bluetooth or a Lightning cable.	Yes	Go to step 19.	`\${nodeText.yesSymptomCode}`	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Keyboard to the known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Keyboard connect and pair using USB?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K30	KEYBOARD
19.	Verify that the known-good computer can recognize the user's wireless keyboard.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K15	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not recognized by known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 20.	`\${nodeText.noSymptomCode}`	
20.	Verify that the known-good computer can pair with the user's wireless keyboard using Bluetooth.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K07	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard cannot pair with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 21.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
21.	Verify that the known-good computer maintains a Bluetooth connection to the user's wireless keyboard, and does not drop this connection.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K08	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard intermittently loses its connection with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 22.	\$(nodeText.noSymptomCode)	
22.	Ask the user how often and how long the wireless keyboard is used.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Explain to the user that the battery issue could likely be caused by the user using the wireless keyboard continuously over a long period of time, rather than any fault of the wireless keyboard itself, macOS, or the user's computer. Gain agreement from the user that lengthy wireless keyboard usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless keyboard itself. Does the user agree that the battery life issue is likely caused by lengthy wireless keyboard usage?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K32	KEYBOARD
23.	Attempt to charge the user's wireless keyboard battery for several more minutes. Verify that the user's wireless keyboard battery charge level that appears on the known-good computer that is paired with this user's wireless keyboard has increased and shows that the user's wireless keyboard is charging.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K31	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery will not charge Note: This symptom does not apply to peripherals with replaceable batteries. Does the user's wireless keyboard exhibit this symptom?	No	Go to step 24.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
24.	Closely inspect the user's wireless keyboard enclosure for signs of a swollen battery.	Yes	Replace the user's wireless keyboard.	K33	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 25.	\$(nodeText.noSymptomCode)	
25.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K01	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> One or more keys do not work <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 26.	\$(nodeText.noSymptomCode)	
26.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K05	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys seem to stick, do not respond properly, or respond slowly <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 27.	\$(nodeText.noSymptomCode)	
27.	Verify that each and every wireless keyboard key is intact and not missing.	Yes	Replace the user's wireless keyboard.	K27	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys missing or falling off <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 28.	\$(nodeText.noSymptomCode)	
28.	Verify that the wireless keyboard language is as expected.	Yes	Replace the user's wireless keyboard.	K04	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Wrong keyboard language version <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
29.	Look for for any signs of power on the user's wireless mouse or trackpad, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 30.	\${nodeText.yesSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns on when the on/off button or switch is placed in the on position.	No	Go to step 34.	\${nodeText.noSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns off when the on/off button or switch is placed in the off position.				
	Does the user's wireless mouse or trackpad exhibit any power-related symptoms?				
30.	Confirm that the issue with the user's wireless mouse or trackpad is:	Yes	Replace the user's wireless mouse or trackpad.	K09	MOUSE
	<ul style="list-style-type: none"> User's wireless mouse or trackpad is not functioning at all (seems dead, no power, power LED does not turn on) 		Verify that the issue is resolved.		
	Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 31.	\${nodeText.noSymptomCode}	
31.	Verify that the user's wireless mouse or trackpad turns on when the on/off button or switch is placed in the on position.	Yes	Replace the user's wireless mouse or trackpad.	K19	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is:		Verify that the issue is resolved.		
	<ul style="list-style-type: none"> on/off switch or button is defective 	No	Go to step 32.	\${nodeText.noSymptomCode}	
32.	Does the user's wireless mouse or trackpad exhibit this symptom?	Yes	Replace the user's wireless mouse or trackpad.	K34	MOUSE
	Verify that the user's wireless mouse or trackpad turns off when the on/off button or switch is placed in the off position.		Verify that the issue is resolved.		
	Confirm that the issue with the user's wireless mouse or trackpad is:	No	Go to step 33.	\${nodeText.noSymptomCode}	
	<ul style="list-style-type: none"> User's wireless mouse or trackpad remains on when the on/off button or switch has been placed in the off position 				
	Does the user's wireless mouse or trackpad exhibit this symptom?				

	Check	Result	Action	Code	Commodity
33.	Verify if the user's wireless mouse or trackpad has any other power-related issue that is not related to the on/off button or switch.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K20	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> Power Issue, not due to on/off button or switch Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 34.	\$(nodeText.noSymptomCode)	
34.	If the user's issue involves pairing or connecting to a Magic Mouse 2 or Magic Trackpad 2, then you can connect to and pair these devices with a computer using either Bluetooth or a Lightning cable.	Yes	Go to step 35.	\$(nodeText.yesSymptomCode)	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Mouse 2 or Magic Trackpad 2 to a known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Mouse 2 or Magic Trackpad 2 connect and pair using USB?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K30	MOUSE
35.	Verify that the known-good computer can recognize the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K15	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad is not recognized by known-good computer. Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 36.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
36.	Verify that the known-good computer can pair with the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K07	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad cannot pair with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 37.	\$(nodeText.noSymptomCode)	
37.	Verify that the known-good computer maintains a Bluetooth connection to the user's wireless mouse or trackpad, and does not drop this connection.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K08	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad intermittently loses its connection with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 38.	\$(nodeText.noSymptomCode)	
38.	Ask the user how often and how long the wireless mouse or trackpad is used.	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
	Gain agreement from the user that lengthy wireless mouse or trackpad usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless mouse or trackpad itself. Does the user agree that the battery life issue is likely caused by lengthy wireless device usage?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K32	MOUSE

	Check	Result	Action	Code	Commodity
39.	Attempt to charge the user's wireless mouse or trackpad battery for several more minutes. Verify that the user's wireless mouse or trackpad battery charge level that appears on the known-good computer that is paired with this user's wireless mouse or trackpad has increased and shows that the user's wireless mouse or trackpad is charging.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K31	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery will not charge <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 40.	\$(nodeText.noSymptomCode)	
40.	Closely inspect the user's wireless mouse or trackpad enclosure for signs of a swollen battery.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K33	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 41.	\$(nodeText.noSymptomCode)	
41.	Isolate failure to either user's wireless mouse or wireless trackpad.	Wireless mouse	Go to step 42.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless trackpad	Go to step 45.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
42.	Verify that the overall function of the user's wireless mouse performs as expected when used with the known-good computer.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K26	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> No mouse response Does the user's wireless mouse exhibit this symptom?	No	Go to step 43.	\$(nodeText.noSymptomCode)	
43.	Verify that the clicking function of the user's wireless mouse performs as expected when pressed and released.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K14	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Mouse clicking function not working properly Does the user's wireless mouse exhibit this symptom?	No	Go to step 44.	\$(nodeText.noSymptomCode)	
44.	Verify that the touch gesture function of the user's wireless mouse performs as expected when the mouse surface is touched.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K18	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Touch/Multi-Touch gesture issue Does the user's wireless mouse exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
45.	Verify that the overall function of the user's wireless trackpad performs as expected when used with the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K23	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not responding Does the user's wireless trackpad exhibit this symptom?	No	Go to step 46.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
46.	Verify that the user's wireless trackpad exhibits smooth continuous tracking when used with the known-good computer, and does not skip or behave erratically.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K12	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not tracking properly Does the user's wireless trackpad exhibit this symptom?	No	Go to step 47.	\$(nodeText.noSymptomCode)	
47.	Verify that the clicking function of the user's wireless trackpad performs as expected when pressed and released, and that the click is recognized by the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K13	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click not recognized Does the user's wireless trackpad exhibit this symptom?	No	Go to step 48.	\$(nodeText.noSymptomCode)	
48.	Verify that the user's wireless trackpad clicking function does not require excessive force when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K24	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad requires high click force Does the user's wireless trackpad exhibit this symptom?	No	Go to step 49.	\$(nodeText.noSymptomCode)	
49.	Verify that the user's wireless trackpad clicking function is not overly sensitive to clicking when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K25	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click oversensitive Does the user's wireless trackpad exhibit this symptom?	No	Go to step 50.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
50.	Verify that the user's wireless trackpad Force Touch function performs as expected and that haptic feedback is felt in response. Note: This feature does not apply to all models.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K29	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad Force Touch or haptic feedback issue 	No	Issue cannot be duplicated.	<code> \${nodeText.noSymptomCode} </code>	
	Does the user's wireless trackpad exhibit this symptom?				

External Apple Wired Keyboard and Mouse

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Apple wired USB keyboard or mouse does not function with user's computer or shows one or more of the following symptoms:</p> <ul style="list-style-type: none">• One or more mouse buttons do not click• Mouse scroll ball does not operate smoothly• No mouse response• Keys stick• Keys loose or missing• One or more keys do not respond when pressed• No keyboard response at all• Apple wired mouse causes erratic cursor tracking• Apple wired keyboard or mouse is not recognized• Apple wired keyboard or mouse has physical damage that affects operation• Paint wearing off of one or more keys• Apple wired keyboard or mouse has cosmetic damage that does not affect operation <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Disconnect all USB devices from the user's computer except for the user's mouse or keyboard. Troubleshoot only one device at a time to help isolate the issue.2. Unplug the keyboard or mouse from the USB port, wait a few seconds, and reconnect it.3. Connect the keyboard or mouse to another USB port on the user's computer.4. Make sure the USB connectors are plugged in completely and correctly.5. Visually inspect the USB connectors and ports for damage or debris.6. Try operating the user's mouse on another surface. Ask the user about the type of surface usually being used with the mouse. Glossy or transparent surfaces, or those with repetitive patterns, may cause mouse-tracking errors or faulty mouse operation. Explain that solid, nonreflective, opaque surfaces work best. The surface should be clean, but not shiny.7. Visually inspect the user's keyboard or mouse for dirt, hair, liquid damage, or other debris. Check to see if the user has pets. Pet hair can lie across the laser and cause intermittent mouse issues. Refer to article HT204172: How to clean your Apple products for information on cleaning the user's keyboard or mouse.8. Connect the user's USB keyboard or mouse to an available USB port on a known-good computer to determine if the issue is related to the USB port on the user's computer, or to the user's USB keyboard or mouse. If the user's keyboard or mouse functions when used with the known-good computer, go to the “USB Port Not Recognized” troubleshooting flow.9. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work and HT203162: One or more keys on the keyboard do not respond for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's USB mouse or keyboard to verify that the attached USB cable and connector are not damaged or frayed.</p> <p>Check user's keyboard or mouse for physical and liquid damage.</p> <p>On mice, verify that all mouse buttons click and laser tracking LED illuminates.</p> <p>On keyboards, verify that all keys are present and can be depressed normally.</p> <p>Does the user's USB mouse or keyboard, or its attached cable or connector, show signs of damage?</p>	Yes	Go to step 2.	\${nodeText.yesSymptomCode}	
		No	Go to step 12.	\${nodeText.noSymptomCode}	
2.	<p>Isolate damage issue to either user's wired USB keyboard or mouse.</p> <p>Which peripheral is damaged?</p>	USB Keyboard	Go to step 3.	\${nodeText.yesSymptomCode}	
		USB Mouse	Go to step 9.	\${nodeText.noSymptomCode}	
3.	<p>Closely examine user's keyboard to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, and liquid damage to keyboard.</p> <p>Is damage to user's keyboard related to liquid spill?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	KEYBOARD
		No	Go to step 4.	\${nodeText.noSymptomCode}	
4.	<p>Click each key to ensure no keys are sticking in the down or up position.</p> <p>Is damage to user's keyboard related to sticky keys or slow key response?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K05	KEYBOARD
		No	Go to step 5.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
5.	Look for any loose or missing keycaps. Is damage to user's keyboard related to loose or missing keycaps?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K27	KEYBOARD
		No	Go to step 6.	\${nodeText.noSymptomCode}	
6.	Closely inspect the keyboard for any signs of physical damage that may affect operation. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K16	KEYBOARD
		No	Go to Step 7.	\${nodeText.noSymptomCode}	
7.	Closely examine the keyboard for signs of paint wearing off of one or more keys. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K35	KEYBOARD
		No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Closely inspect the keyboard for any signs of cosmetic damage that does not affect operation.</p> <p>Does the user's keyboard exhibit this symptom?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K21	KEYBOARD
		No	Issue cannot be duplicated.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
9.	<p>Closely examine user's mouse to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, and liquid damage to mouse.</p> <p>Is damage to user's mouse related to liquid spill?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	MOUSE
		No	Go to step 10.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
10.	<p>Closely inspect the mouse for any signs of physical damage that may affect operation.</p> <p>Is there physical damage to user's mouse?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K16	MOUSE
		No	Go to step 11.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	

	Check	Result	Action	Code	Commodity
11.	Closely inspect the mouse for any signs of cosmetic damage that does not affect operation.	Yes	Replace USB mouse. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K21	MOUSE
	Is there cosmetic damage to user's mouse?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
12.	Isolate failure issue to either user's wired USB keyboard or mouse.	USB Keyboard	Go to step 17.	\${nodeText.yesSymptomCode}	
	Which peripheral is malfunctioning?	USB Mouse	Gp to step 13.	\${nodeText.noSymptomCode}	
13.	Connect user's USB mouse to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the mouse.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Is mouse recognized by a known-good computer?	No	Replace USB mouse. Verify issue resolved.	K15	MOUSE
14.	Move the mouse and verify that the cursor on the known-good computer screen moves smoothly.	Yes	Replace USB mouse. Verify issue resolved.	K26	MOUSE
	Is issue related to mouse function?	No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	Click and roll the mouse's scroll ball to check that it rolls freely in all directions and with no physical resistance.	Yes	Replace USB mouse. Verify issue resolved.	K06	MOUSE
	Is issue related to the scroll ball?	No	Go to step 16.	\${nodeText.noSymptomCode}	
16.	Press the mouse's various buttons to verify that they click properly, without sticking, every time they are pressed.	Yes	Replace USB mouse. Verify issue resolved.	K14	MOUSE
	Is issue related to the mouse button(s)?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
17.	Connect user's USB keyboard to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the keyboard.	Yes	Go to step 18.	\${nodeText.yesSymptomCode}	
	Is keyboard recognized by a known-good computer?	No	Replace USB keyboard. Verify issue resolved.	K15	KEYBOARD

	Check	Result	Action	Code	Commodity
18.	Verify that all keys functions as expected when pressed and released.	Yes	Replace USB keyboard. Verify issue resolved.	K01	KEYBOARD
	Is issue related to specific keys not working?	No	Go to step 19.	\${nodeText.noSymptomCode}	
19.	Verify that the keyboard language is as expected.	Yes	Replace USB keyboard. Verify issue resolved.	K04	KEYBOARD
	Is issue related to keyboard language?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	

Internal Microphone Issues

Unlikely causes:

Battery, camera, DisplayPort cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Microphone not working, but audio output is functional• Microphone audio is garbled• Internal microphone input cannot be selected• Line audio input functions properly <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. On user's computer go to System Preferences > Sound and verify the following:<ul style="list-style-type: none">◦ Input tab:<ul style="list-style-type: none">▪ "Internal microphone" source is available and selected.▪ Input volume slider is not set to zero.◦ Output tab:<ul style="list-style-type: none">▪ Sound output device is set to Internal Speakers.▪ Output volume is not muted or set to zero.2. Go to System Preferences > Sound > Input tab, and verify that "Input level" indicator moves when speaking into microphone.3. Launch QuickTime Player. Choose New Audio Recording from File menu. Choose Built-in Microphone from right pop-up menu, and adjust input volume using slider in center of window.4. Check that no cables are inserted into audio input or output jacks. Use an otoscope to visually inspect both jacks. Use compressed air to clean and remove any debris.5. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.6. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers Does issue persist with a known-good OS?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	Disconnect any connected headphones or external speakers. Check whether System Preferences > Sound > Input tab shows an "Internal microphone" source available and selected. Does System Preferences list "External microphone" instead?	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Run AST 2 Audio Test to verify that built-in microphone detects expected audio test patterns produced from each speaker. Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
	<p>Remove display panel.</p> <p>Locate and disconnect microphone cable from logic board.</p> <p>Inspect the microphone opening to ensure it is not covered by incorrect installation of a VHB strip. If VHB is covering the microphone, follow service guide procedures to remove and install the correct VHB strip in that area.</p> <p>The microphone is located along the lower inner side of the display panel opening in the front of the enclosure, and is connected to the logic board with a small flex cable.</p> <p>Inspect the cable and connector on the logic board for any damage.</p> <p>Is there any damage to the microphone cable or connector?</p>	No	Go to step 6.	\$(nodeText.noSymptomCode}	
5.	<p>Determine whether the damage is located on the microphone cable, the logic board, or a combination of multiple components.</p> <p>Is the damage limited to the microphone cable only?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Microphone is part of rear enclosure. Replace rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
6.	Reseat the microphone cable connector to the logic board. Retest by going to System Preferences > Sound > Input tab, and verifying that the input level indicator moves when speaking into the microphone.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Go to step 9.	`\${nodeText.noSymptomCode}`	
	Is the microphone recognized and functional?				
7.	Run AST 2 Audio Test to verify that built-in microphone detects expected audio test patterns produced from each speaker.	Yes	The issue was resolved by reseating the microphone cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Refer to article TP587: Using Audio Test .	No	Go to step 8.	`\${nodeText.noSymptomCode}`	
	Does unit pass AST 2 Audio Test?				
8.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good logic board?	No	Replace logic board. Verify issue resolved.	M09	MLB
9.	Substitute a known-good logic board.	Yes	Replace logic board. Verify issue resolved.	M09	MLB
	Retest by going to System Preferences > Sound > Input tab, and verifying that the input level indicator moves when speaking into the microphone.		ESCALATION REQUIRED.		
	Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Microphone is part of rear enclosure. Replace rear enclosure. Verify issue resolved. Inform user that failures due to accidental damage are not covered by Apple’s one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .	`\${nodeText.noSymptomCode}`	
	Is the microphone recognized and functional?		Contact ACS for additional support regarding warranty coverage for this part.		

	Check	Result	Action	Code	Commodity
10.	Verify that the “Internal microphone” device is available, selected, and functional, and that the input level indicator moves when speaking into the microphone. Then record a sample audio file and play it back to verify that it is free of distortion.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
	Is issue resolved?				

No Audio from Internal Speaker(s) or Headphone Jack

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, fan, hard disk drive (HDD), hard drive data or power or combo cable, display panel, memory, power supply, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No sound from internal speaker(s).• No sound from left and/or right speaker channel.• No sound from headphone jack. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Adjust volume controls to verify setting is above minimum, and audio is not muted.2. Test with known-good stereo sound file.3. Check that nothing is inserted into external audio port. Use an otoscope to visually inspect the port. Use compressed air to clean and remove any debris.4. Connect headphones or external speakers to external audio port. Verify in System Preferences > Sound > Output that Audio Out setting switches to Headphones, and whether audio can be played on external speakers.5. Disconnect any device connected to external audio port. In System Preferences > Sound > Output, check that sound output device reverts to Internal Speakers. Use Balance slider to isolate left and right speakers and check whether issue is limited to one speaker.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer versions to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version.</p> <p>Does the audio issue persist from a known-good OS?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	<p>Connect headphones or external speakers to computer and retest. Adjust volume setting to verify audio out to headphones/external speakers.</p> <p>Can you hear audio through headphones/external speakers?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable to audio I/O ports and its corresponding connection on logic board.</p> <p>Did you find damage to audio cable or logic board connector?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
4.	<p>Determine whether damage is on the logic board, audio cable, or both.</p> <p>Is the damage limited to logic board?</p>	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good logic board?	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
6.	Substitute known-good logic board and retest. Can you hear audio through headphones/external speakers?	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\${nodeText.noSymptomCode}	
7.	Run AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
	Refer to article TP587: Using Audio Test .				
	Does unit pass Audio Test?	No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate speaker connections on logic board. Disconnect and inspect both speaker cable connectors and corresponding connectors on logic board for damage.</p> <p>Reconnect the left and right speakers to the logic board, verifying that the connections are all seated properly.</p> <p>Did you find damage to speakers or logic board connector?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 10.	\${nodeText.noSymptomCode}	
9.	<p>Determine whether damage is on the logic board, speakers, or both.</p> <p>Is the damage limited to speaker(s)?</p>	Yes	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
10.	With speaker connectors reseated to logic board, verify you can hear audio through internal speakers.	Yes	The issue was resolved by reseating cables. Verify resolution.	\${nodeText.yesSymptomCode}	
	<p>In System Preferences > Sound > Output tab, adjust Balance slider to check left and right speaker channel separation.</p> <p>Play music with high and low tones to check bass and tweeter performance of left and right speakers.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Do internal speakers present full range of expected audio performance?</p>	No	Go to step 11.	\${nodeText.noSymptomCode}	
11.	To troubleshoot this issue completely, a known-good internal speaker set is required.	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
	<p>Internal speakers are specified to work as a matched pair and must be tested or replaced as matched pairs.</p> <p>Keep and identify your known-good speakers from one kit as a matched pair.</p> <p>Do you have immediate access to a known-good speaker set?</p>	No	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good internal speaker set and verify you can hear audio through internal speakers.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.	X08	OTHER ELECTRIC
	Retest using AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.		Verify that the issue is resolved.		
	Refer to article TP587: Using Audio Test . Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
13.	Does unit pass Audio Test?				
	Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the issue resolved?				

No Audio to External Display Speakers

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Video but no audio to external display; audio works on internal speakers <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> 1. Gather display type and model information from the user. 2. Always use a known-good USB-C Digital AV Multiport Adapter and known-good HDMI display equipped with internal speaker(s) to verify the computer. Review article HT201853: About Apple video adapters and cables to help identify which adapters can be used with this computer model. 3. In System Preferences > Sound > Output, select the available DisplayPort, Thunderbolt, HDMI, or USB output device type (the output name varies depending on the display model). 4. On the HDMI display, verify that the correct input has been selected. 5. Connect the video adapter to each USB-C connector on the computer and retest each time, to isolate a possible faulty USB-C port on the user's computer. 6. Test the audio output using more than one application or website. 7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 8. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. 9. With the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter connected to the computer, check for and apply the latest software and firmware updates. 10. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> • HT204154: About Thunderbolt ports and displays • HT202488: About Apple Thunderbolt cables and adapters <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.</p> <p>Check System Preferences > Sound > Output for an available DisplayPort output device type. Select the available device type, adjust the volume level on the display, and play the audio file or source.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Can the external display audio be selected and play audio in both plug orientations?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
2.	<p>Connect the known-good display and HDMI cable to the user's USB-C Digital AV Multiport Adapter, then to the computer.</p> <p>Check System Preferences > Sound > Output for an available HDMI output device type. Select the available device type, adjust the volume level on the display, and play the audio file or source.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Can the external display audio be selected and play audio in both plug orientations?</p>	Yes	<p>The issue is isolated to the user's display or HDMI cable. Inform the user of findings and refer to article HT204388: Frequently asked questions about using HDMI with Mac computers for more information.</p>	\$(nodeText.yesSymptomCode)	
		No	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
3.	Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	{nodeText.yesSymptomCode}	
	Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.				
	Check System Preferences > Sound > Output for an available DisplayPort, HDMI, or USB Output device type. Select the available device type, adjust the output volume level, and play the audio file or source.	No	Go to step 4.	{nodeText.noSymptomCode}	
	Can the external display audio be selected and play audio from a known-good OS?				
4.	Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 5.	{nodeText.yesSymptomCode}	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Replace logic board. Verify that the issue is resolved.	M09	MLB
5.	Is any USB-C port damaged?	Yes	Replace the rear enclosure. Verify that the issue is resolved.	X13	ENCLOSURE
	Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.				
	Is the opening for the USB-C port damaged or deformed?	No	Replace logic board. Verify that the issue is resolved.	M24	MLB
6.	Play a known-good audio file or source and verify that the sound output to display speakers is functional.	Yes	The issue is resolved. Verify resolution.	{nodeText.yesSymptomCode}	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Verify that the issue is resolved.				
	Is issue resolved?				

No Video to External Display

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> External display is not detected when connected to computer External display does not show any video <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> Gather display type and model information from the user. Always use a known-good USB-C Digital AV Multiport Adapter and known-good HDMI display equipped with internal speaker(s) to verify the computer. Review article HT201853: About Apple video adapters and cables to help identify which adapters can be used with this computer model. Refer to article HT201177: Get help with video issues on external displays connected to your Mac for common causes of video issues. On the HDMI display, verify that the correct input has been selected. Connect the video adapter to each USB-C connector on the computer and retest each time, to isolate a possible faulty USB-C port on the user's computer. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac. Retest for external video issues. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. With the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter connected to the computer, check for and apply the latest software and firmware updates. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> HT204154: About Thunderbolt ports and displays HT202488: About Apple Thunderbolt cables and adapters <p>Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP833: iMac and Displays: Power Supply Cover Instructions TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> TP1620: iMac Pro (2017): Power Supply Cover Instructions TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.</p> <p>Check System Preferences > Displays for an available external HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Does a good image appear on the external display in both plug orientations?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
2.	<p>Connect the known-good display and HDMI cable to the user's USB-C Digital AV Multiport Adapter, then to the computer.</p> <p>Check System Preferences > Displays for an available external HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Does a good image appear on the external display in both plug orientations?</p>	Yes	<p>The issue is isolated to the user's display or HDMI cable. Inform the user of findings and refer to article HT204388: Mac computers: Frequently asked questions about using HDMI for more information.</p>	\$(nodeText.yesSymptomCode)	
		No	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
3.	Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	{nodeText.yesSymptomCode}	
	Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.				
4.	Check System Preferences > Displays for an available external HDMI display type. Select the available device type.	No	Go to step 4.	{nodeText.noSymptomCode}	
	Verify that the external display can be selected and that a good image appears on the external display.				
5.	Does a good image appear on the external display?	Yes	Go to step 5.	{nodeText.yesSymptomCode}	
	Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.				
6.	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Replace logic board. Verify that the issue is resolved.	M26	MLB
	Is any USB-C port damaged?				
7.	Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.	Yes	Replace the rear enclosure. Verify that the issue is resolved.	X13	ENCLOSURE
	Is the opening for the USB-C port damaged or deformed?				
8.	Restart the computer and verify that a known-good external display works over both VGA and digital AV adapters.	Yes	The issue is resolved. Verify resolution.	{nodeText.yesSymptomCode}	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.				
9.	Verify that the issue is resolved.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
	Is issue resolved?				

USB Port Not Recognized

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Standard USB devices not recognized or not powered. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Disconnect all USB devices.Verify that the user's USB device is compatible with the computer. Refer to HT201163: Using USB devices with your Mac for more information about compatibility with various USB devices.Verify that any USB hubs connected to the computer have sufficient power for a connected USB device.Check to see whether the user's USB device requires a specific driver to function properly.Check System Information > USB device tree to see whether the computer recognizes internal USB devices (Bluetooth, IR, camera).Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates.Test each USB port using a known-good Apple wired keyboard or mouse.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect USB ports for lint, debris, or other foreign material. Remove debris with an anti-static brush.	Yes	Issue resolved. Return computer to user, explaining that debris in USB port caused issue and what to do to prevent contamination in the future.	\$(nodeText.yesSymptomCode)	
	Is known-good Apple USB device functional and recognized?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Inspect all USB receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	Is any USB port damaged?	No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	Inspect the opening on the rear enclosure for the USB receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB plugs.	Yes	Replace the rear enclosure. Verify that the issue is resolved.	X13	ENCLOSURE
	Is the opening for the USB port damaged or deformed?	No	Replace logic board. Verify that the issue is resolved.	M24	MLB
4.	Disconnect all USB devices. Verify whether known-good Apple wired keyboard or mouse functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
	Is known-good Apple USB device functional and recognized?	No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Continue to use known-good Apple wired keyboard or mouse. Start up computer using known-good, up-to-date, bootable macOS volume. Verify whether known-good USB device functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Is a known-good Apple USB device functional and recognized?	No	Replace logic board. Verify that the issue is resolved.	M15	MLB
6.		Yes	Issue resolved by directory repair in Disk Utility. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Use Disk Utility to repair the file directory on internal hard drive. Restart and verify whether a known-good USB device functions correctly and is recognized in System Information > USB device tree. Is known-good Apple USB device functional and recognized?	No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	<p>This computer can support one high-powered USB device (iPad, iPhone, or USB hard drive for example) at a time.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. See article HT204377: Powering peripherals through USB for more information.</p> <p>Do you have immediate access to a known-good, high-powered USB device that draws over 900 mA?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
8.	<p>Connect known-good, high-powered USB device to one of the computer's USB ports. In System Information > USB device tree, "Current Available (mA)" and "Extra Operating Current (mA)" should each report 900 mA.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify that known-good USB device functions as expected.</p> <p>Does "Extra Operating Current" appear in System Information?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M38	MLB
9.	<p>Connect exact same high-powered USB device to next USB port. Make sure nothing is plugged into other port(s). Both "Current Available (mA)" and "Extra Operating Current (mA)" should each report 900 mA in System Information. Repeat action with every available USB port.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify USB device operates as expected.</p> <p>Does "Extra Operating Current" appear in System Information?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M38	MLB

	Check	Result	Action	Code	Commodity
10.	<p>Try user's USB device with a known-good computer. Verify whether it functions normally and is recognized in System Information > USB device tree.</p> <p>Is user's USB device functional and recognized?</p>	Yes	Issue resolved by testing USB ports and verifying user's USB device. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	<p>Advise user to do the following:</p> <ul style="list-style-type: none"> • Contact USB device manufacturer for support. • Verify system requirements and Mac compatibility. • Find out whether device requires additional software. 	\$(nodeText.noSymptomCode)	
11.	<p>Confirm that a known-good USB device is functional and recognized.</p> <p>Check System Information for correct power allocation to USB device.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

USB-C and Thunderbolt Connectivity Issues

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> Standard USB-C devices are not recognized or not powered when connected to computer's USB-C port(s). USB 2 or USB 3 devices are not recognized or not powered when connected to computer's USB-C port(s). External DisplayPort or Thunderbolt devices or displays are not recognized when connected to computer's USB-C port(s). <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> Verify that any USB hubs connected to the computer have sufficient power for a connected USB device. Check whether the user's USB device requires a specific driver to function properly. If the user is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. Retest for USB-C connectivity issues. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Using a Wi-Fi network, check for and apply the latest software and firmware updates. Also check for adapter firmware updates by leaving the user's adapter connected to the computer while running software update. If an update is available, update the adapter's firmware before proceeding further, and retest for USB-C connectivity issues. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> HT207256: Connect with Thunderbolt 3 on your new MacBook Pro HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook HT204154: About Thunderbolt ports and displays HT206909: Networking two Mac systems directly with a Thunderbolt 3 cable requires Thunderbolt-enabled hosts HT207113: How to daisy-chain USB 2.0 devices to Thunderbolt 3 ports <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP833: iMac and Displays: Power Supply Cover Instructions TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017) refer to articles:</p> <ul style="list-style-type: none"> TP1620: iMac Pro (2017): Power Supply Cover Instructions TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	<p>Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.</p> <p>Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.</p> <p>Is any USB-C port damaged?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Go to step 3.	\$(nodeText.noSymptomCode}	
2.	<p>Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.</p> <p>Is the opening for the USB-C port damaged or deformed?</p>	Yes	<p>Replace the rear enclosure.</p> <p>Verify that the issue is resolved.</p>	X13	ENCLOSURE
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	<p>Using a known-good Apple USB-C to USB Adapter, connect a known-good high-speed USB (1.1/2.0) device, such as a mouse, keyboard, or USB 2 flash drive to the same USB-C port on the computer.</p> <p>Verify in System Information > USB that the device is detected.</p> <p>Is the USB 1.1/2.0 device detected?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M15	MLB
4.	<p>Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > USB that the device is detected.</p> <p>Is the USB 1.1/2.0 device detected?</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M15	MLB

	Check	Result	Action	Code	Commodity
5.	Using a known-good Apple USB-C to USB Adapter, connect a known-good USB 3 device, such as a USB 3 hard drive or flash drive to the same USB-C port on the computer. Verify in System Information > USB that the device is detected. Is the USB 3 device detected?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M15	MLB
6.	Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations. Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar. Verify in System Information > USB that the device is detected. Is the USB 3 device detected?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M15	MLB
7.	Using the user's Apple USB-C to USB Adapter in place of the known-good adapter, connect a known-good USB 3 device, such as a USB 3 hard drive or flash drive to the same USB-C port on the computer. Refer to HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook for more information about Apple USB-C adapters. Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar. Verify in System Information > USB that the device is detected. Be sure to test both orientations. Is the USB 3 device detected?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode}	
		No	Replace the user's Apple USB-C adapter. If the adapter is made by a third party, advise the user to contact the manufacturer for support. Verify that the issue is resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
8.	<p>Using a known-good Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter, connect a known-good external Thunderbolt 2 device such as a display or external disk to the same USB-C port on the computer.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Refer to HT207266: Connect devices and displays with the Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter for more information about this adapter.</p> <p>Is the Thunderbolt 2 device detected?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
9.	<p>Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Is the Thunderbolt 2 device detected?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
10.	Using the user's Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter in place of the known-good adapter, connect a known-good external Thunderbolt 2 device such as a display or external disk to the same USB-C port on the computer.	Yes	Go to "No Video on External Display" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	<p>Refer to HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook for more information about Apple USB-C adapters.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Be sure to test both orientations.</p> <p>Is the Thunderbolt 2 device detected?</p>	No	<p>Replace the user's Apple USB-C adapter.</p> <p>If the adapter is made by a third party, advise the user to contact the manufacturer for support.</p> <p>Verify that the issue is resolved.</p>	X03	EXTERNAL CABLE
11.	Confirm that known-good USB high-speed and SuperSpeed devices and Thunderbolt devices are functional and recognized when connected to all USB-C ports on the computer, in both orientations.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

External USB ODD Noisy

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Note: Be sure you understand what type of optical drive noise you should be concerned about and what noises you can safely ignore. The following lists help distinguish normal, functional optical drive sounds from noises that may indicate drive malfunction.</p> <p>Typical noises include sounds made during the following activities:</p> <ul style="list-style-type: none">• Waking computer from sleep• Burning a CD or DVD• Inserting a disc• Ejecting a disc• Importing (“ripping”) an audio CD in iTunes• Playing a DVD• Accessing an idle disc <p>Abnormal noises include the following:</p> <ul style="list-style-type: none">• Grinding• Loud, repeated clicking• Scraping sounds• Constantly seeking or cycling the eject mechanism with no disc inserted <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none">• Noise during start up• Noise during operation• Noise when drive is copying or saving data <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Verify that the user’s issue involves only abnormal sounds, as defined in symptoms.2. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.3. Verify that there is not an additional label adhered to the disc which could cause the disc to lose balance and create excessive noise when rotating at high speed.4. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.5. Compare optical drive noise to a known-good equivalent Apple USB SuperDrive.6. Verify that the noise issue does not involve waking the computer. When starting up or waking from sleep, the Apple USB SuperDrive may make unfamiliar noises.7. Test the user’s optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.8. Test Apple USB SuperDrive with known-good discs. Verify media is free to spin without scraping edge or surface of media.9. Verify noise during seek activity is excessive. Seek noise should subside once disc is mounted.10. Verify disc spin noise is excessive. Disc spin should cease 30 seconds after mounting disc in Finder.11. Inspect the Apple USB SuperDrive drive slot for obstructions such as debris or a stuck disc.12. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.13. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.14. The Apple USB SuperDrive must be plugged directly into computer’s USB port, and cannot be used while connected to a USB hub.15. Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.16. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.17. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check whether the Apple USB SuperDrive is constantly seeking or cycling eject mechanism with no optical disc inserted. Optical drive should perform only one reset sequence and then rest idly, ready for media. Does the optical drive spin, seek, and/or reset continuously without an optical disc inserted?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Closely inspect the user's Apple USB SuperDrive to determine whether a disc or other debris is stuck inside. Is a disc or other debris stuck in drive?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Insert a known-good optical disc, then eject the disc. Listen carefully to Apple USB SuperDrive disc handling. Eject noise should consist of a pop as disc is released from motor hub, then gear movement as motor pushes disc out of slot. Repeat test several times. Is disc eject noise abnormal and excessive over multiple trials?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Disconnect the Apple USB SuperDrive and retest for computer noise. Has the noise been eliminated?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to "Noise/Hum/Vibration" troubleshooting flow.	\$(nodeText.noSymptomCode)	
6.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical drive sounds. Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL

	Check	Result	Action	Code	Commodity
7.	Substitute a known-good Apple USB SuperDrive and retest.	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
	Has the noise been eliminated?	No	Go to “Noise/Hum/Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	
8.	Verify that the Apple USB SuperDrive does not make any abnormal noises.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Is the issue resolved?	No	Go to “Noise/Hum/Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	

External USB ODD Not Recognized

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Discs cannot be inserted.• Discs can be inserted, but are ejected immediately.• Discs can be inserted, but are ejected after drive has spun up for a few seconds.• Discs can be inserted and ejected, but do not appear in Finder. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Go to Finder Preferences > General and make sure “CDs, DVDs, and iPods” is checked under “Show these items on the desktop.”2. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.3. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.4. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example)5. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.6. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.7. The Apple USB SuperDrive must be plugged directly into the computer’s USB port, and cannot be used while connected to a USB hub.8. Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.9. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.10. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.11. Connect the user’s Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, or Mac mini (Early 2009 or later) to verify drive’s functionality separately from user’s computer.12. Disconnect the user’s Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user’s computer to verify the computer’s functionality separately from the user’s drive. If the issue persists, troubleshoot as a faulty USB port on the user’s computer.13. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the user's Apple USB SuperDrive to an available USB port on user's computer and start up the computer. Check System Information > Hardware > USB device tree to verify the presence of the optical drive.</p> <p>Repeat this process using each USB port on the user's computer to verify all of the computer's USB ports are functioning.</p> <p>Does drive appear in System Information when connected to every USB port?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to "USB Port Not Recognized" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
2.	<p>Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up.</p> <p>Does disc auto-eject shortly after insertion?</p>	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>After insertion, verify that the disc spins and the disc volume mounts in the Finder.</p> <p>Does drive mount known-good disc?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J09	OPTICAL
4.	<p>Check to see whether the Apple USB SuperDrive properly mounts and reads both known-good CD and DVD media.</p> <p>If only one type of media is recognized, there may be a laser issue.</p> <p>Can drive read both media types?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to "External USB ODD Read/Write or Performance Issues" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
5.	<p>Insert, mount, and eject both a known-good CD and DVD.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	J99	

External USB ODD Read/Write or Performance Issues

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Errors when writing to optical media• Errors when reading from optical media• Hangs when accessing or writing data• Read or write speeds slower than expected <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Test known-good, compatible optical media in user's Apple USB SuperDrive connected to a known-good computer.3. Go to System Information > Hardware > Disc Burning to compare actual disc burning specifications to user's expectations.4. See articles HT2543: About optical disc drive burning and write speeds and HT2882: Factors that affect writing to or reading from optical media to learn more about disc burning and how performance is affected by write speeds, media types, software, and more.5. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.6. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac's USB ports while sitting on a flat surface alongside iMac.7. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).8. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.9. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper drive operation. Verify user's configuration is supported.10. The Apple USB SuperDrive must be directly plugged into the computer's USB port and cannot be used while connected to a USB hub.11. With the Apple USB SuperDrive connected to the user's computer, restart the computer while pressing the mouse button or Eject key to cycle the optical drive.12. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.13. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.14. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Insert media into the Apple USB SuperDrive and listen for scraping/scratching noises as the disc spins up. Eject the disc and examine its surface and edges for scrapes or scratches. Verify that the disc can spin without the optical drive scraping the edge or surface of the media. Does media spin freely in the drive?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in the drive?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	Go to step 4.	\$(nodeText.noSymptomCode}	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Verify that the optical drive can properly read known-good CDs. Can the optical drive read CDs?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
5.	Verify that the optical drive can properly read known-good DVDs. Can the optical drive read DVDs?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
6.	Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode}	
7.	Burn test data to CD and DVD media compatible with the Apple USB SuperDrive. Verify that the burned media is recognized and readable by the drive. Can the optical drive read its own burned media?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J03	OPTICAL

	Check	Result	Action	Code	Commodity
8.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical disc read and burn times. Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
9.	Using the same media type and brand, compare read and burn times of the user's Apple USB SuperDrive connected to a known-good computer, against a known-good Apple USB SuperDrive connected to the same computer. Does the user's drive have significantly longer read or burn times than a known-good drive?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
		No	Issue resolved.	\$(nodeText.noSymptomCode}	
10.	Test all Apple USB SuperDrive functions and drive performance to verify a successful repair. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	J99	

External USB ODD Rejects, Does Not Accept, or Does Not Eject Media

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Cannot insert a disc into drive.• Cannot eject a disc from drive.• Drive ejects discs immediately after insertion. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Connect the user's Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, or Mac mini (Early 2009 or later) to verify drive's functionality separately from user's computer.3. Disconnect the user's Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user's computer to verify the computer's functionality separately from the user's drive. If the issue persists, troubleshoot as a faulty USB port on the user's computer.4. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.5. Verify that optical drive is actually an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the computer.6. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).7. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.8. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.9. The Apple USB SuperDrive must be plugged directly into the computer's USB port, and cannot be used while connected to a USB hub.10. Leave the Apple USB SuperDrive connected to the user's computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.11. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.12. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.13. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in drive?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Verify known-good disc can fit through enclosure slot. Is clearance in enclosure slot sufficient for disc insertion?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Closely inspect entire Apple USB SuperDrive enclosure for dents, scratches, or other indications of impact or abuse. Is insufficient clearance due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
5.	Inspect the slot on the optical drive assembly for proper disc clearance. Is clearance in optical drive slot sufficient for disc insertion?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	When a CD or DVD pops off the spindle inside an optical drive (usually due to impact to the drive) and remains in the drive mechanism, the loose disc prevents the slot from being able to open fully, creating a "closed condition." Inspect the slot in the optical drive to determine if it is "closed" (not accepting discs). If the disc slot is closed, inspect the drive mechanism, especially the drive enclosure, for evidence of drop damage. Note: If the disc slot is closed, but there is no sign of accidental damage, choose "No" to the question below. Is disc slot access closed due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Inspect the slot in the Apple USB SuperDrive to determine if it is “closed” (not accepting discs) because of a stuck disc. Is disc slot access closed because of a stuck disc?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Make sure the optical drive assembly is mounted into the enclosure correctly and is properly aligned with the enclosure slot opening. Is the drive assembly properly aligned with the enclosure slot opening?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and align the optical drive assembly with the enclosure's bezel slot. Retest the Apple USB SuperDrive by inserting, mounting and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved. Apple USB SuperDrive alignment realigned disc inject function. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
10.	Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up. Does the disc immediately auto-eject?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	After insertion, verify that the disc spins and the disc volume mounts in the Finder. Does the disc volume mount?	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
		No	Go to “External USB ODD Read/Write or Performance Issues” troubleshooting flow.	\$(nodeText.noSymptomCode)	
12.	Eject the disc by dragging the disc icon to Trash or selecting the disc icon and pressing the Eject key or Command-E on the keyboard. Does the disc eject properly?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J02	OPTICAL

	Check	Result	Action	Code	Commodity
13.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
	Does user want to proceed with out-of-warranty repair?	No	Issue resolved. Using proper positioning, return the drive to the user.	\$(nodeText.noSymptomCode)	
15.	Insert, mount, and eject a known-good optical disc. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	J99	

HDD Noisy

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard drive data or power or combo cable, display panel, left speaker, logic board, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<p>Note: Be sure you understand what type of hard drive noise you should be concerned about, and what noises you can safely ignore. The following descriptions help distinguish normal, functional hard drive sounds from noises that may indicate drive malfunction.</p> <p>Noises such as occasional quiet chirping or beeping are typically normal hard drive sounds.</p> <p>Refer to article TS3204: iMac: Evaluating System noises to determine whether noise is within expected range.</p> <p>Abnormal noises such as grinding or loud, repeated clicking or scraping sounds may be indications of a more serious issue.</p> <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none">Noise during start upNoise during operationNoise when drive copies or saves data <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Important: Always ask whether user's data has been backed up prior to repair.</p> <ol style="list-style-type: none">Verify that user's issue involves only abnormal sounds, as defined in symptoms.Compare hard drive noise to a known-good equivalent computer. Refer to article TS3204: iMac: Evaluating System noises to determine if noise is within expected range.Check for and apply latest software and firmware updates.If the computer model is internally equipped with both a hard disk drive (HDD) and a solid-state drive (SSD), refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Use macOS Recovery to troubleshoot potential software issues and to verify hard drive presence. Hold down Command-R during startup to restart from recovery partition. Launch Disk Utility.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	See article HT201314: About macOS Recovery for more information.	No	Go to "HDD/SSD/Flash Storage Not Recognized / Not Mounting / Read/Write Issues" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
	Does hard drive appear in Disk Utility?				

	Check	Result	Action	Code	Commodity
2.	Verify that hard drive SMART status in Disk Utility shows as Verified. Is SMART status Verified?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to “HDD/SSD/Flash Storage Not Recognized / Not Mounting / Read/Write Issues” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
3.	Use Disk Utility to repair hard disk directory. Did Disk Utility repair directory or finish without error?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Consult article HT204319: macOS versions and builds included with Mac computers to determine correct version and build of macOS for this iMac; then erase and reinstall. Important: Always ask whether user’s data has been backed up prior to repair. Did installation successfully finish, and did computer start up to the desktop?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to “HDD/SSD/Flash Storage Not Recognized / Not Mounting / Read/Write Issues” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
5.	Restart computer and listen closely for abnormal noise. Has abnormal noise been eliminated?	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	Disconnect internal hard drive and start up from a known-good, up-to-date, bootable macOS volume. Has noise been eliminated?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Go to “Noise/Hum/Vibration” troubleshooting flow.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	<p>To confirm that drive is mounted properly, remove hard drive and verify the following:</p> <ul style="list-style-type: none"> • Rubber vibration isolation bumper is properly installed around hard drive, and does not appear worn, cracked, out-of-position, or otherwise damaged. • Hard drive bracket is securely positioned over hard drive, is fastened to rear enclosure with appropriate screws, and does not appear loose, bent, or otherwise damaged. • Any other internal components that were loosened during take-apart process have been retightened. For example, power supply or speaker screws may need to be loosened to gain access to hard drive bracket. After this is done, these components must be retightened to ensure they do not cause noise due to loose components vibrating against other parts, or against enclosure, especially around the chin area. <p>Are hard drive mounting components undamaged and installed properly?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace missing or damaged components:</p> <ul style="list-style-type: none"> • Hard drive bracket • Rubber vibration isolation bumper 	X13	PIECE PART
8.	<p>To troubleshoot this issue completely, a known-good hard drive is required.</p> <p>Do you have immediate access to a known-good hard drive?</p>	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		No	Replace hard drive. Verify issue resolved.	H06	HDD
9.	<p>Substitute a known-good hard drive and retest.</p> <p>Has noise been eliminated?</p>	Yes	Replace hard drive. Verify issue resolved.	H06	HDD
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	H99	

	Check	Result	Action	Code	Commodity
10.	Confirm that computer no longer makes any abnormal noises.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	H99	

HDD/SSD/Flash Storage Not Recognized / Not Mounting / Read/Write Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> Boots to gray screen Boots to blue screen Displays flashing folder with question mark or prohibitive symbol Cannot save documents Displays read/write error message(s) Hangs when accessing or saving data Drive or volume is not recognized in Disk Utility (icon is grayed out), after a failed data migration to a Mac with Fusion Drive or solid-state drive (SSD) / flash storage. Cannot erase volume, and bootable drive is not shown in Disk Utility. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Important: Always ask whether user's data has been backed up prior to repair.</p> <p>Important: Some Macs that have been updated to macOS High Sierra may not start up to the internal startup volume after logic board replacement. On affected Macs, the Mac BootROM Updater is available to address this issue. This utility updates the EFI BootROM on affected Macs to allow starting up to a volume that has been updated to the APFS file system.</p> <p>If the user's computer does not start up to the internal startup volume after logic board replacement, run the Mac BootROM Updater to ensure the replacement logic board's EFI BootROM firmware is updated to the latest version that supports the APFS file system.</p> <p>For more information and instructions for downloading and using the Mac BootROM Updater, see article OP476: Latest Apple Service Toolkit download links and documentation.</p> <ol style="list-style-type: none"> 1. Disconnect all peripherals and attempt to start up computer. 2. To restore default startup disk, reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 3. Reset SMC using procedure listed for this computer in article HT201295: Intel-based Macs: Resetting the System Management Controller (SMC). 4. If the computer is internally equipped with both a hard disk drive (HDD) and a solid-state drive (SSD) / flash storage, refer to article HT202574: About Fusion Drive, a storage option for some Mac computers for specific troubleshooting and restore processes. <p>Important: Using Disk Utility to erase or partition a Fusion Drive or SSD might leave the drive without a usable partition. If this occurs, follow the steps in HT205401: Use Terminal to recover an unusable Fusion Drive or SSD disk partition and reinstall macOS Sierra or OS X El Capitan to resolve the issue.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP833: iMac and Displays: Power Supply Cover Instructions TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	<p>Press the power button to start up the computer.</p> <p>Confirm that computer completes the startup process: Apple logo > progress indicator > login screen > desktop or installer screen.</p> <p>During startup, allow up to four minutes for a defective internal hard drive or flash storage to time out, after which the computer will start up from a known-good external device.</p> <p>Does computer complete the startup process?</p>	No	Go to “Will Not Start Up” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
2.	Run AST Storage Diagnostic on the user's computer and examine the results of the test.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Do all internal drive tests pass in Storage Diagnostic?	No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	Examine Storage Diagnostic results for presence of an internal drive.	Pass	Go to step 4.	`\${nodeText.yesSymptomCode}`	
	Did drive presence test PASS or FAIL?	Fail	Go to step 16.	`\${nodeText.noSymptomCode}`	
4.	Examine Storage Diagnostic results for SMART status.	Pass	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Did SMART test PASS or FAIL?	Fail	Go to step 9.	`\${nodeText.noSymptomCode}`	
5.	Examine Storage Diagnostic results for Short Random Multi-Block Read Test.	Pass	Go to step 6.	`\${nodeText.yesSymptomCode}`	
	Did Short Random Multi-Block Read Test PASS or FAIL?	Fail	Go to step 16.	`\${nodeText.noSymptomCode}`	
6.	Examine Storage Diagnostic results for File System Check.	Pass	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Did File System Check PASS or FAIL?	Fail	Go to step 10.	`\${nodeText.noSymptomCode}`	
7.	Examine Storage Diagnostic results for Bootable Volume Presence Check.	Pass	Go to step 8.	`\${nodeText.yesSymptomCode}`	
	Did Bootable Volume Check PASS or FAIL?	Fail	Go to step 10.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
8.	Examine Storage Diagnostic results for Last OS Reinstall Check.	Pass	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Did Last OS Reinstall Check PASS or FAIL?	Fail	Go to step 10.	`\${nodeText.noSymptomCode}`	
9.	Identify the type of storage device affected: <ul style="list-style-type: none"> • Hard disk drive (HDD) • Flash storage / solid-state drive (SSD) 	HDD	Replace the user's hard drive. Verify issue resolved.	H05	HDD
	Is the affected device an HDD or SSD?	SSD	Replace the user's SSD/flash storage. Verify issue resolved.	H05	SSD
10.	Restart while holding down the Command-R keys to start up from the recovery partition.	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
	Does computer start up from recovery tools partition?	No	Go to step 11.	`\${nodeText.noSymptomCode}`	
11.	If macOS is present but not able to restart from the recovery partition, or the partition is missing, consult article HT202294: macOS: About Recovery Disk Assistant to restore the partition. Restart from the new recovery partition, holding down Command-R during restart.	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
	Does computer start up from newly created recovery tools partition?	No	Go to step 16.	`\${nodeText.noSymptomCode}`	
12.	In Disk Utility, select the Partition tab, then click the Option button to verify that the partition table is correctly set to GUID. Try to repair the partition using Disk Utility.	Yes	Go to step 15.	`\${nodeText.yesSymptomCode}`	
	Does Disk Utility successfully repair the partition?	No	Go to step 13.	`\${nodeText.noSymptomCode}`	
13.	Follow all steps listed in HT204743: Partition a problematic drive two times before recommending service or replacement .	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
	This will force a rewrite of the partitions table. Does Disk Utility successfully partition the drive without any errors?	No	Go to step 16.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
14.	Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Does computer complete the start up process?	Yes	Go to step 15.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
15.	Run AST Storage Diagnostic on the user's computer again, and examine the results of the test. Do all internal drive tests pass in Storage Diagnostic?	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
16.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Attempt to isolate which mass storage component is involved with this issue: <ul style="list-style-type: none"> • Hard disk drive (HDD) • Flash storage / solid-state drive (SSD) Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	HDD	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		SSD	Go to step 23.	`\${nodeText.noSymptomCode}`	
	Is this an HDD or SSD Issue?				

	Check	Result	Action	Code	Commodity
17.	<p>Disconnect and inspect the hard drive data and power cables from the logic board. Look for damage on logic board connectors and both cable connectors.</p> <p>Check for damaged or corroded cable connectors and missing or bent pins on logic board connectors.</p> <p>Did you find damage to hard drive cables or logic board connectors?</p>	Yes	Go to step 18.	\${nodeText.yesSymptomCode}	
		No	Go to step 19.	\${nodeText.noSymptomCode}	
18.	<p>Damage to multiple parts requires an escalation to ACS for repair approval.</p> <p>Is damage limited to hard drive cables?</p>	Yes	Replace hard drive data and power cables, or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
19.	<p>Reconnect the hard drive data and power cables to the logic board.</p> <p>Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.</p> <p>Do all internal drive tests pass in Storage Diagnostic?</p>	Yes	Issue resolved by reseating hard drive cable. Verify issue resolved.	\${nodeText.yesSymptomCode}	
		No	Go to step 20.	\${nodeText.noSymptomCode}	
20.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> • Hard drive • Hard drive data and power cables, or hard drive combo cable (depending on model). <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 21.	\${nodeText.yesSymptomCode}	
		No	Replace hard drive. Verify issue resolved.	H01	HDD

	Check	Result	Action	Code	Commodity
21.	Substitute known-good hard drive data and power cables, or hard drive combo cable (depending on model) to test with user's hard drive.	Yes	Replace hard drive data and power cables, or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
	Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.	No	Go to step 22.	\${nodeText.noSymptomCode}	
	Do all internal drive tests pass in Storage Diagnostic?				
22.	Continue to use known-good hard drive cable and substitute a known-good hard drive.	Yes	Replace hard drive. Reinstall user's hard drive cable. Verify issue resolved.	H01	HDD
	Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.	No	Replace logic board. Reinstall user's hard drive and cable. Verify issue resolved.	M19	MLB
	Do all internal drive tests pass in Storage Diagnostic?				
23.	Disconnect and inspect SSD/flash storage. Look for damage on logic board connector and SSD/flash storage.	Yes	Go to step 24.	\${nodeText.yesSymptomCode}	
	Check for damaged or corroded card edge connectors and missing or bent pins on logic board connector.	No	Go to step 25.	\${nodeText.noSymptomCode}	
	Did you find damage to SSD/flash storage or logic board connectors?				
24.	Damage to multiple parts requires an escalation to ACS for repair approval.	Yes	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
25.	Reconnect SSD or flash storage to logic board.	Yes	Issue resolved by reseating SSD/flash storage. Verify issue resolved.	\${nodeText.yesSymptomCode}	
	Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.	No	Go to step 26.	\${nodeText.noSymptomCode}	
	Do all internal drive tests pass in Storage Diagnostic?				

	Check	Result	Action	Code	Commodity
26.	To troubleshoot this issue completely, a known-good SSD or flash storage is required. Do you have immediate access to known-good SSD/flash storage?	Yes	Go to step 27.	\${nodeText.yesSymptomCode}	
		No	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
27.	Substitute a known-good SSD or flash storage. Run AST Storage Diagnostic on the user's computer again, and examine the results of the test. Do all internal drive tests pass in Storage Diagnostic?	Yes	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
		No	Replace logic board. Reinstall the user's SSD/flash storage. Verify issue resolved.	M19	MLB
28.	Confirm that the computer can successfully start up from the internal HDD/SSD/flash storage. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	

SD Memory Card Cannot Be Inserted Into Slot

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Cannot insert SD card into slot.• Can insert SD card only part way into slot.• Card slot does not align with enclosure. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Check that the user's SD card is not warped or damaged, and that the metal contacts are clean, intact and corrosion-free.2. Verify that the SD card is the correct size. Card dimensions should be 32 mm x 24 mm x 2.1 mm. Note: Cards thicker than 2.1 mm are too thick and may damage the card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to article HT204384: About the SD and SDXC card slot on your Mac for further information.3. Verify that the computer's SD card slot is not obstructed in any way. Use a flashlight to look into slot to make sure nothing is already inserted. If so, carefully remove the obstruction from the slot. Try to reinsert the SD card. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Insert known-good, formatted SD card into user's computer. Verify that it seats correctly.</p> <p>Does known-good SD card seat correctly when inserted?</p>	Yes	Issue resolved. Defective or incompatible SD card. Advise user to contact SD card vendor for support. Refer them to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\${nodeText.yesSymptomCode}	
		No	Go to step 2.	\${nodeText.noSymptomCode}	
2.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Remove chin strap to avoid bending or damaging it while aligning logic board.</p> <p>Loosen but do not remove all logic board screws. You should be able to shift board position slightly, both left to right and up and down. Take care to avoid damaging cabling or other components while moving logic board.</p> <p>Insert known-good SD card again.</p> <p>Can you now insert known-good SD card correctly?</p>	Yes	Go to step 3.	\${nodeText.yesSymptomCode}	
		No	Replace logic board. Verify issue resolved.	M27	MLB
3.	<p>Hold the logic board in position and tighten all logic board screws. Insert the known-good SD card again.</p> <p>Can you now insert and remove known-good SD card correctly?</p>	Yes	Issue resolved with logic board alignment. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Replace logic board. Verify issue resolved.	M27	MLB
4.	<p>Verify that a known-good SD memory card can be fully inserted into and ejected from slot and that it seats correctly.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

SD Memory Card Not Recognized

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD) / flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">SD card does not appear on desktop or in System Information. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Make sure the SD card is unlocked.Check that the user's SD card is not warped or damaged and that the metal contacts are clean, intact, and corrosion free.Verify that the computer's SD card slot is not damaged or obstructed. Use a flashlight to inspect the slot to make sure nothing is already inserted. If so, carefully remove the obstruction from the slot. Try to reinsert the SD card.Verify that the SD card is the correct size. Card dimensions should be 32 mm x 24 mm x 2.1 mm. Note: Cards thicker than 2.1 mm are too thick and may damage card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to article HT204384: About the SD and SDXC card slot on your Mac for further specifications.Consult article HT204384: About the SD and SDXC card slot on your Mac and check for compatible SD card type and format.<ul style="list-style-type: none">SD card slot can accommodate cards that are Standard SD (Secure Digital) 4MB to 2GB, SDHC (Secure Digital High Capacity) 4GB to 32GB, and SDXC (Secure Digital Extended Capacity) 4GB to 2TB. MMC cards can also be used in this slot.While SDIO (Secure Digital Input Output) cards fit into and should not damage the card slot, they are not supported.MiniSD and Micro SD cards require adapters.For a more specific SD card type or format (wireless-enabled SD card or other SD card for example), make sure the correct driver is installed. macOS supports only standard SD memory cards; other cards may require specific driver software.Make sure Finder Preferences > General is set to show External Disks.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Insert a known-good, formatted SD card into user's computer. Verify that card seats correctly. Does known-good SD card seat correctly when inserted?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "SD Memory Card Cannot Be Inserted Into Slot" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Verify that a known-good SD card appears in Disk Utility and mounts in Finder. Verify that computer can read data from and write data to card. Can computer read from and write to known-good SD card?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Start up user's computer with restore partition or up-to-date, bootable macOS volume. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Verify that a known-good SD card appears and mounts in Disk Utility and Finder. Can computer now read from and write to known-good SD card?	Yes	Repair permissions and directory using Disk Utility. If issue persists, restore macOS (with correct system build). Retest to verify resolution. Check that user has necessary driver software.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Check System Information to verify that SD card reader is listed in USB devices. Does SD card reader appear in System Information?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board, which includes SD card reader. Verify issue resolved.	M27	MLB
5.	Insert user's SD card into user's computer. Verify that it seats correctly. Does user's SD card seat correctly when inserted?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	
6.	Verify that SD card appears in left column of Disk Utility. If card does not appear, eject and reinsert card. If inserted too slowly, card may not appear. Does SD card appear in Disk Utility?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Insert user's SD card into a known-good computer. Verify that computer can read data from and write data to SD card.	Yes	Repair permissions and directory on user's computer using Disk Utility. If issue persists, restore macOS (with correct system build). Retest to verify resolution. Check that user has necessary driver software.	\$(nodeText.yesSymptomCode)	
	Can a known-good computer read from and write to user's SD card?	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	
8.	Verify that user's SD card volume appears in Disk Utility and mounts in Finder.	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
	Does card volume mount in Finder or Disk Utility?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Format user's SD Card as macOS Extended Journaled with a GUID partition scheme.	Yes	Issue resolved by reformatting SD card. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Important: Make sure user has a valid backup first. If formatting is successful, retest SD card by writing data to and retrieving data from card.</p> <p>Were you able to reformat, then write to and read from the card successfully?</p>	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	<p>Test user's SD card by writing data to and retrieving data from card.</p> <p>Were you able to write to and read from user's card successfully?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Verify issue resolved.</p> <p>If the issue persists, contact ACS for additional support.</p>	M99	
		No	<p>Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.</p>	\$(nodeText.noSymptomCode)	
11.	<p>Verify that user's computer can successfully read from and write to a known-good SD card.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Burnt Smell / Odor

Unlikely causes:

Rear enclosure, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer emits a burnt, smoky, or other unusual odor <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Verify that the computer is the source of odor.Disconnect all third-party devices to eliminate external devices as source of odor.Odors can be related to how new the product is. Refer to article HT202324: New equipment: Odors may be present short-term.Determine whether this is a safety issue. Refer to article OP44: Handling Potential Product Safety Issues.Inspect the enclosure and components for obvious signs of burning or smoky residue. Check rear vents, slots, ports, and power cord. Refer to article HT203529: Smoke emitted may be from failed component.Inspect the air intake vents and outlets for any obstructions. Make sure air can flow freely into and out of enclosure.Clean the enclosure to eliminate odors resulting from external contamination. Refer to article HT204172: How to clean your Apple products. Explain the cause to the user.Verify functionality of the computer. If the computer is nonfunctional, troubleshoot that first as a separate issue. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Closely inspect computer for a possible safety issue.</p> <p>Have you identified any safety issues?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for safety-related issues.</p> <p>Refer to article OP44: Handling Potential Product Safety Issues.</p>	T99	
		No	Go to step 2.	\${nodeText.noSymptomCode}	
2.	<p>Odor can be related to external contamination. Inspect computer exterior for contamination or lack of cleanliness.</p> <p>Can you determine that odor is caused by external contamination?</p>	Yes	Go to step 3.	\${nodeText.yesSymptomCode}	
		No	Go to step 4.	\${nodeText.noSymptomCode}	
3.	<p>Thoroughly clean the entire enclosure and all external surfaces. Refer to article HT204172: How to clean your Apple products. Explain cause to the user.</p> <p>Does user agree that odor is due to external contamination?</p>	Yes	Issue resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support.</p>	M99	
4.	<p>Odors can be related to how new the product is. Refer to article HT202324: New equipment: Odors may be present short-term.</p> <p>Can you determine that odor is due to newness?</p>	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
		No	Go to step 6.	\${nodeText.noSymptomCode}	
5.	<p>Explain to user that new computers can sometimes emit an odor similar to odors generated by new carpeting or a new car. In most cases, odor dissipates after a brief period. Refer user to article HT202324: New equipment: Odors may be present short-term.</p> <p>Does user agree odor is related to computer's newness?</p>	Yes	Issue resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support.</p>	M99	

	Check	Result	Action	Code	Commodity
6.	<p>Inspect each module and its associated cables for signs of burnt or damaged components, smoke residue or other traces of burning, and melted or damaged wiring.</p> <p>Have you identified a component failure as source of odor?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS to troubleshoot burnt or failed components.</p>	M99	
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>Closely inspect internal components and enclosure for indications of physical damage or internal contamination.</p> <p>Can you identify signs of internal damage or contamination?</p>	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Go to step 9.	\${nodeText.noSymptomCode}	
8.	<p>Inform the user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.</p> <p>Does user want to proceed with out-of-warranty repair?</p>	Yes	Proceed with out-of-warranty repair. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Issue resolved. Return computer to user using correct positioning.	\${nodeText.noSymptomCode}	
9.	<p>Run the computer for several hours and monitor for the issue/odor.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>If no functional failure is detected, use correct positioning to explain to the user that the odor is related to external contamination or the computer being new.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Computer Runs Hot

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, hard drive data or power or combo cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Computer feels unusually warm. • Fan is not operating. • Fan is not functioning to its full capacity. • Fan runs constantly at high speeds. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> 1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan. 2. Check for and apply latest software and firmware updates. 3. Inspect fan performance during operation to make sure fan is spinning. Check that vents are not blocked, and if necessary, use compressed air to remove dust or debris from rear fan exhaust. 4. Compare computer's operating temperature to a known-good, similarly configured computer. 5. Check for runaway applications using the information in article HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity. Follow the instructions to halt any processes that are using excessive system resources. 6. Processor-intensive/graphics-intensive applications and system processes may cause the enclosure to feel warm. Use Activity Monitor to identify these types of programs and explain issue to user. 7. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. 8. Verify that computer's internal hard drive or flash storage is an Apple-installed part. Compare hard drive information in System Information to the Apple Hard Drives Matrix in article SM155: Hard Drives Matrix to determine whether user's installed drive is one of OEM drives available for this computer configuration. Third-party hard drives without correct firmware or thermal sensors, or outside this computer's specifications, may cause computer to run hot or permanently activate fan at full speed. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	Run diagnostics or Mac Resource Inspector (MRI) and consult diagnostic logs to check for fan (motor) or sensor failures.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	<p>An inoperative or clogged fan can cause the computer to run hot.</p> <p>Sensor(s) that indicate they are out of normal operating range can help isolate why the computer is running hot.</p> <p>Does computer pass all MRI checks?</p>	No	Go to step 8.	`\${nodeText.noSymptomCode}`	
2.	<p>Use extended version of Cooling System Diagnostics (CSD) to verify proper function of the following subsystems:</p> <ul style="list-style-type: none"> • SMC • Fan • Thermal sensors • CPU–heat sink thermal interface <p>Does computer pass all CSD tests?</p>	Yes	Computer passed all CSD tests. Verify operation and refer user to article HT202179: Learn about the fans in your Mac.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with CSD.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does computer pass all CSD checks?</p>	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to known-good fan?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
5.	Substitute a known-good fan and retest using MRI and CSD. Does computer now pass MRI and CSD tests?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
7.	Continue to use known-good fan. Substitute a known-good logic board. Reassemble computer and retest with MRI. Do both known-good fan and logic board pass MRI and run-in tests?	Yes	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
		No	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
8.	Determine specific type of failure reported in diagnostics: thermal/fan sensor or voltage/current sensor. <ul style="list-style-type: none"> MRI thermal sensors begin with Txxx. MRI electrical voltage sensors begin with Vxxx. MRI electrical current sensors begin with Ixxx. Which sensor failure does diagnostics report?	Voltage/Current Sensor	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		Thermal/Fan Sensor	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Some power-related sensors are located in power supply, but are read through a SMBus connection to logic board.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does MRI report a VDxx or IDxx test failure?</p>	Yes	Go to step 10.	`\${nodeText.yesSymptomCode}`	
		No/Other	Go to step 13.	`\${nodeText.noSymptomCode}`	
10.	<p>Reseat DC power cable connection to logic board. Reassemble and retest, using MRI.</p> <p>Does MRI still report a VDxx or IDxx sensor test failure?</p>	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	Issue resolved by reseating DC power cable connection between power supply and logic board. Verify resolution.	`\${nodeText.noSymptomCode}`	
11.	<p>To troubleshoot this issue completely, a known-good power supply is required.</p> <p>Do you have immediate access to a known-good power supply?</p>	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	<p>DC power cable is part of power supply.</p> <p>Replace power supply.</p> <p>Verify that the issue is resolved.</p>	P17	POWER SUPPLY

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good power supply, reassemble and retest using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Reinstall user's power supply. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P17	POWER SUPPLY
13.	Most voltage and current regulators are located on logic board. To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
14.	Substitute a known-good logic board, reassemble and retest using MRI. Does MRI still report a Vxxx or Ixxx sensor test failure?	Yes	Reinstall user's logic board. Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
15.	Identify specific type of failure reported in MRI/diagnostics: thermal sensor or fan (motor) error. MRI thermal sensors begin with Txxx. Which sensor failure does diagnostics report?	Fan (Motor)	Go to step 16.	`\${nodeText.yesSymptomCode}`	
		Thermal	Go to step 22.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
16.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Refer to the service guide Functional Overview to locate affected fan connection to logic board. Disconnect fan cable connectors and inspect logic board and fan cable connector pins for damage.</p> <p>Is there any cable or connector damage on fan or logic board?</p>	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 19.	`\${nodeText.noSymptomCode}`	
17.	<p>Identify whether fan, logic board, or both are damaged.</p> <p>Are both fan and logic board damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	`\${nodeText.yesSymptomCode}`	
		No	Go to step 18.	`\${nodeText.noSymptomCode}`	
18.	<p>Identify whether fan or logic board is damaged.</p> <p>Which part is damaged?</p>	Fan	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		Logic Board	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M24	MLB

	Check	Result	Action	Code	Commodity
19.	Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 20.	`\${nodeText.noSymptomCode}`	
20.	Does computer pass fan motor check? To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to a known-good fan?	Yes	Go to step 21.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
21.	Substitute a known-good fan, and retest using MRI. Does computer now pass fan motor check?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
22.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 23.	`\${nodeText.yesSymptomCode}`	
	Remove display panel. Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseat fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does MRI still report a Txxx thermal sensor test failure?	No	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.noSymptomCode}`	
23.	Identify whether a thermal sensor that is currently failing MRI test is related to the logic board.	Yes	Replace logic board.	M23	MLB
	Refer to service documentation for information about thermal sensors.		Use Blank Board Serializer (BBS) to set the computer's serial number.		
	Is a logic board thermal sensor failing a test?	No	Go to step 24.	`\${nodeText.noSymptomCode}`	
24.	Identify whether a thermal sensor that is currently failing MRI test is related to the Hard Disk Drive (HDD) or Flash Storage.	Yes	Go to step 25.	`\${nodeText.yesSymptomCode}`	
	Note: Some models do not have a HDD.	No	Go to step 29.	`\${nodeText.noSymptomCode}`	
	Is a hard drive or flash storage thermal sensor failing a test?				

	Check	Result	Action	Code	Commodity
25.	Verify in article SM155: Hard Drives Matrix that the installed hard drive or flash storage model is compatible with this computer configuration. Is installed HDD or flash storage compatible with this model?	Yes	Go to step 26.	`\${nodeText.yesSymptomCode}`	
		No	Unsupported HDD or Flash Storage installed, or missing/incorrect hard drive thermal sensor. Check with user for out-of-warranty resolution. Verify resolution.	`\${nodeText.noSymptomCode}`	
26.	Identify the type of storage device affected: <ul style="list-style-type: none"> Hard Disk Drive (HDD) Flash Storage Is the affected device an HDD or flash storage?	HDD	Go to step 27.	`\${nodeText.yesSymptomCode}`	
		Flash Storage	Replace the user's flash storage. Verify issue resolved.	H85	SSD
27.	To troubleshoot this issue completely, a known-good hard drive data cable or hard drive combo cable (depending on model) is required. Do you have immediate access to a known-good hard drive data cable or hard drive combo cable?	Yes	Go to step 28.	`\${nodeText.yesSymptomCode}`	
		No	Replace the user's hard drive. Verify issue resolved.	H85	HDD
28.	Substitute a known-good hard drive data cable or hard drive combo cable (depending on model) and retest using MRI. Does computer now pass the THxx sensor check?	Yes	Replace the user's hard drive data cable or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
		No	Reinstall user's hard drive data cable or combo cable (depending on model). Replace the user's hard drive. Verify issue resolved.	H85	HDD
29.	Identify whether a thermal sensor that is currently failing MRI test is related to the power supply. Is a power supply thermal sensor failing a test?	Yes	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
		No	Go to step 30.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
30.	<p>Identify whether a thermal sensor that is currently failing MRI test is related to the display.</p> <p>Is a display thermal sensor failing a test?</p>	Yes	Go to step 31.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
31.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 32.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L85	LCD
32.	<p>Substitute a known-good display panel and retest using MRI.</p> <p>Does MRI still report a TL0p or TL1p thermal sensor test failure?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L85	LCD
33.	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Mechanical/Physical/Cosmetic Damage

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>The computer shows signs of physical and/or cosmetic damage such as:</p> <p>Enclosure and stand:</p> <ul style="list-style-type: none">• Stand hinge is loose or broken.• Stand is bent, loose, or broken.• Screw is stripped, loose, or missing.• Scratches.• Dents.• Cracks.• Liquid spill. <p>Display Assembly:</p> <ul style="list-style-type: none">• Broken glass.• Cracked display panel.• Scratches.• Dents.• Liquid spill. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Inspect computer and discuss nature of issue with user. Determine whether user wants to proceed with repair (despite possible accidental damage) or pursue other service options. Click “No” to proceed with further troubleshooting.</p> <p>Note: For input device issues, including damage, go to the “External Apple Bluetooth Peripherals” or “External Apple Wired Keyboard and Mouse” troubleshooting flows.</p>

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine cause of damage or defect: user/technician, environment, accidental damage, or abuse.	Yes	ESCALATION REQUIRED. Contact ACS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for damage or defect on computer?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Closely examine the user's computer for signs of enclosure damage, such as the following: <ul style="list-style-type: none">• Stand hinge is loose or broken.• Screw is stripped, loose, or missing.• Stand is bent, loose, or broken.	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	X12	ENCLOSURE
	Does the computer exhibit this type of damage?	No	Go to step 3.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	<p>Closely examine the user's computer for signs of enclosure damage, such as the following:</p> <ul style="list-style-type: none"> • Scratches • Dents • Cracks <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X13	ENCLOSURE
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Closely examine the user's computer enclosure for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's enclosure.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X90	ENCLOSURE
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Closely examine the user's computer for signs of display damage, such as a cracked, dented, or broken display frame and/or assembly housing.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L18	LCD
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Closely examine the user's computer display panel for signs of cosmetic damage, such as the following:</p> <ul style="list-style-type: none"> • Scratches • Dents <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L19	LCD
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	<p>Closely examine the user's computer display panel for signs of a single hairline crack.</p> <p>A single hairline crack is one continuous curved or straight crack. It may travel across the whole screen or cover a small area.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L35	LCD
	Does the computer exhibit this type of damage?	No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Closely examine the user's computer display panel for signs of multiple cracks.</p> <p>Two or more glass cracks, or two or more hairline cracks, count as multiple cracks.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L36	LCD
	Does the computer exhibit this type of damage?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Closely examine the user's computer display panel for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's display panel.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L90	LCD
	Does the computer exhibit this type of damage?	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for assistance with Apple-related accidental damage.</p>	\$(nodeText.noSymptomCode)	

Noise/Hum/Vibration

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, logic board, memory, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Buzzing noise• Rattling noise• Ticking noise• Squeaking noise• Humming noise• High frequency noise• Mechanical vibration <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">1. Work with the user to reproduce the issue and isolate the source of noise. Differentiate whether the noise is coming from the computer or a connected peripheral. Disconnect all third-party peripherals to isolate the source of noise.2. Determine whether the sound is normal or abnormal. Refer to article TS3204: iMac: Evaluating System noises for more information.3. If the iMac fan runs at full speed after the computer turns on, you may need to reset the iMac's SMC. Refer to articles HT204463: iMac: Fans run at full speed after computer turns on and HT202179: About fans and fan noise in your Apple product for more information. Reset SMC using procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.4. Verify that the vents on the bottom and back of the computer are free of dust and other obstructions that might inhibit proper airflow through the computer.5. Launch Applications > Utilities > Activity Monitor. Determine whether an application or process is consuming a high percentage of CPU bandwidth. CPU-intensive applications can cause fan to run fast in order to maintain proper internal computer temperatures. If needed, quit application or restart the computer to resolve issue. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Disconnect any peripheral devices, cards, or cables attached to computer.	Yes	Issue resolved. Issue caused by ground loop induced by third-party devices. Advise user to connect all devices to a common power outlet or contact device manufacturer for support.	\$(nodeText.yesSymptomCode)	
	Has the noise been eliminated?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Tilt display to hinge limits to determine whether mechanical noise is generated by hinge mechanism.	Yes	Go to “Stand/Hinge Issues” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Is the noise coming from iMac's display hinge?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Replace power supply. Verify issue resolved.	P04	POWER SUPPLY
	Remove display panel. Connect computer to AC power and listen carefully around power supply to verify whether it is source of noise. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Is noise coming from iMac's power supply?	No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Shut down computer. If you reinstalled display panel, remove it.	Yes	Issue resolved by removing loose objects inside chin area.	\$(nodeText.yesSymptomCode)	
	Hold computer firmly with both hands and invert computer while gently shaking it, to attempt to dislodge and remove any loose screws or other foreign objects that may have fallen down inside the computer into the chin area.				
	Loose objects in the chin area can cause noise or vibration, especially during audio playback.	No	Go to step 5.	\$(nodeText.noSymptomCode)	
	Briefly retest for noise, hum, or vibration.				
5.	Has noise been eliminated?				
	Shut down computer and let it cool off fully. Check for noise, hum or vibration during startup when computer is cold.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
	Does issue happen on or after a cold startup?				
6.	An unreadable thermal sensor can cause fan to run excessively. Run Mac Resource Inspector (MRI) to check thermal sensors.	Yes	Go to “Computer Runs Hot” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
	Does MRI report any thermal sensor failures?				
7.	Excessive fan operation may also occur if computer is unable to read fan speed. Check MRI results for fan (motor) sensor test results.	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
	Does MRI report any fan (motor) failures?				
8.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
		No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Do you have immediate access to known-good fan?				
9.	Substitute known-good fan and retest with MRI.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
		No	Reinstall user's fan. Replace the logic board. Verify issue resolved.	M23	MLB
	Does known-good fan pass fan (motor) test in MRI?				
10.	Disconnect fan and briefly retest for noise, hum, or vibration.	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
	Has noise been eliminated?				

	Check	Result	Action	Code	Commodity
11.	Verify whether any tape, gasket, cable label, cable, or other material is touching fan blades and causing a ticking or buzzing noise. Secure material so it does not touch fan blades. If tape adhesive has lost its stickiness, replace that section of tape.	Yes	Issue resolved by securing internal components or material to prevent touching fan blades. Verify resolution.	\$(nodeText.yesSymptomCode}	
	Remove fan and rotate blades. Verify that fan blades spin smoothly without interference from fan housing, cables, tape, gaskets or other components.				
	Reinstall fan while carefully ensuring that there are no cables routed under or near fan assembly that might cause interference with fan blades. After reassembling computer, verify whether noise issue is resolved.	No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?				
12.	Depending on configuration, there may or may not be a hard drive installed. Other configurations may have either a flash storage card or both flash storage and HDD.	Yes	Go to step 13.	\$(nodeText.yesSymptomCode}	
		No	Go to step 14.	\$(nodeText.noSymptomCode}	
	Is a hard drive installed in computer?				
13.	Remove internal hard drive and start up computer from recovery partition or an up-to-date, bootable macOS volume.	Yes	Go to “HDD Noisy” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
	Has noise been eliminated?	No	Go to step 14.	\$(nodeText.noSymptomCode}	
14.	Play sound sample at loud and soft volume levels to determine whether noise is caused by left/right speakers or amplifier circuit. Plug in external headphones to identify whether noise comes from audio out or from other source. Mute computer volume. Verify whether issue still occurs.	Yes	Go to “Distorted Audio from Internal Speaker(s)” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
		No	Go to step 15.	\$(nodeText.noSymptomCode}	
	Has noise been eliminated?				
15.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 16.	\$(nodeText.yesSymptomCode}	
		No	Go to step 17.	\$(nodeText.noSymptomCode}	
	Do you have immediate access to a known-good fan?				
16.	Substitute known-good fan and retest.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?	No	Go to step 18.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
17.	Disconnect fan and briefly retest for noise, hum, or vibration.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
18.	With hard drive and fan disconnected, briefly retest once again while listening closely for any noise, hum, or vibration coming from logic board and heat sink assembly.	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	<p>Inspect logic board and heat sink assembly for any damage that may have occurred during removal or replacement.</p> <p>Logic board and heat sink assembly must be treated as a single unit during removal or replacement. All screws must be removed from both components prior to physically pulling or pushing either component.</p> <p>Any mishandling of heat sink assembly that is attached to logic board can cause damage to heat pipes connecting these components.</p> <p>If heat pipes become even slightly damaged (bent or kinked for example), normal heat removal cycle can become disrupted, causing a repetitive hammering noise from this area. Damage may not be visibly noticeable.</p> <p>Noise may be mistaken for a faulty hard drive. Check for this noise with hard drive and fan disconnected.</p> <p>Is there noise coming from logic board and heat sink assembly?</p>	No	Go to step 19.	\$(nodeText.noSymptomCode)	
19.	<p>Noise may be related to interference from other electrical devices operating near computer or plugged into same power outlet. See whether noise is eliminated when computer runs in a different location on a different circuit.</p> <p>Has noise been eliminated?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
20.	Confirm that the computer's noise, hum, or vibration has been eliminated.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Stand/Hinge Issues

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bent standBroken hingeStripped screw/headStripped screw boss/threadsLoose stand and/or hinge <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Inspect the computer and discuss the nature of issue with the user. Determine whether the user wants to proceed with repair (despite possible accidental damage) or pursue other service options.Click “No” to proceed with further troubleshooting. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine cause of damage or defects: user/technician, environment, accidental damage, or abuse.	Yes	ESCALATION REQUIRED. Contact ACS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for damage or defect on the computer?	No	Go to step 2.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
2.	Inspect stand to determine whether it requires replacement.	Yes	ESCALATION REQUIRED. Replace stand. Verify issue resolved.	X99	
	Verify that stand securely holds computer in its upright position without wobbling when placed on a hard, smooth, even surface.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Is stand damaged or defective?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Inspect hinge mechanism to determine whether it requires replacement.	Yes	Replace hinge mechanism. Verify issue resolved.	X12	PIECE PART
	Adjust computer back and forth on its hinge, listening for hinge noise. Check feel of the hinge. Its movement should feel firm—not tight or loose—as it holds the iMac in position. Hinge should operate smoothly along its entire travel.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Is hinge mechanism damaged or defective?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Place the customer's iMac on a solid, flat surface.	Yes	ESCALATION REQUIRED. Replace the rear enclosure. Verify issue resolved.	X99	
	Have another person apply downward pressure to the stand to hold it down on that solid surface.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Firmly grasp both sides of the iMac enclosure, and gently attempt to rotate the entire enclosure left and right while facing the display. The enclosure should not be able to move in this direction.	No	Contact ACS for additional support regarding warranty coverage for this part.	\$(nodeText.noSymptomCode)	
	Compare this behavior with a known-good, similar iMac model.				
	If the enclosure rotates an abnormal amount, the mechanism mounts inside the rear enclosure may no longer be securely attached, which may require a rear enclosure replacement.	No	Go to step 5.	\$(nodeText.noSymptomCode)	
	Does the iMac's enclosure rotate an abnormal amount?				

	Check	Result	Action	Code	Commodity
5.	Place the user's iMac on a solid, flat surface and check if one side of the display appears to sit higher or lower than the other side.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Does one side of the iMac appear to sit higher or lower than the other side?	No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	Verify that both stand and hinge operate properly and that they securely hold the iMac upright in all appropriate positions. Is the issue resolved?	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Intermittent Shutdown

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Shuts down during startup • Shuts down unexpectedly during use • Computer restarts spontaneously • Turns off when waking from sleep <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none"> 1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan. 2. Check for and apply latest software and firmware updates. 3. Inspect fan performance during operation to make sure fan is spinning. Check that vents are not blocked, and if necessary, use compressed air to remove dust or debris from rear fan exhaust. 4. Compare computer's operating temperature to a known-good, similarly configured computer. 5. Check for runaway applications using the information in article HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity. Follow the instructions to halt any processes that are using excessive system resources. 6. Processor-intensive/graphics-intensive applications and system processes may cause the enclosure to feel warm. Use Activity Monitor to identify these types of programs and explain issue to user. 7. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. 8. Verify that computer's internal hard drive or flash storage is an Apple-installed part. Compare hard drive information in System Information to the Apple Hard Drives Matrix in article SM155: Hard Drives Matrix to determine whether user's installed drive is one of OEM drives available for this computer configuration. Third-party hard drives without correct firmware or thermal sensors, or outside this computer's specifications, may cause computer to run hot or permanently activate fan at full speed. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run diagnostics or Mac Resource Inspector (MRI) and consult diagnostic logs to check for fan (motor) or sensor failures.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	Sensors that indicate they are out of normal operating range or an inoperative fan can cause intermittent shutdowns. Refer to service documentation for sensor information. Does computer pass all MRI checks?	No	Go to step 5.	`\${nodeText.noSymptomCode}`	
2.	Start up from internal drive and attempt to reproduce shutdown symptom(s).	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
	Can you reproduce shutdown event?	No	Go to step 4.	`\${nodeText.noSymptomCode}`	
3.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
	Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. Does shutdown issue persist?	No	Repair disk directory using Disk Utility. If the issue persists after repair, refer to article HT201260: Find out which macOS your Mac is using and install the correct macOS version and build on user's hard drive. Check for and apply latest software and firmware updates. Verify issue resolved.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not unexpectedly shut down.	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
	Did computer shut down unexpectedly?	No	No failure found during repeated diagnostic testing. Using correct positioning, return computer to user with no trouble found. Verify that the issue is resolved.	\${nodeText.noSymptomCode}	
5.	Determine specific type of failure reported in diagnostics: thermal/fan sensor or voltage/current sensor.	Voltage/Current Sensor	Go to step 6.	\${nodeText.yesSymptomCode}	
	<ul style="list-style-type: none"> • MRI thermal sensors begin with Txxx. • MRI electrical voltage sensors begin with Vxxx. • MRI electrical current sensors begin with Ixxx. Which sensor failure does diagnostics report?	Thermal/Fan Sensor	Go to step 12.	\${nodeText.noSymptomCode}	
6.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
	Remove display panel. Some power-related sensors are located in power supply, but are read through a SMBus connection to logic board. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No/Other	Go to step 10.	\${nodeText.noSymptomCode}	
	Does MRI report a VDxx or IDxx test failure?				

	Check	Result	Action	Code	Commodity
7.	Reseat DC power cable connection to logic board. Reassemble and retest, using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Issue resolved by reseating DC power cable connection between power supply and logic board. Verify resolution.	`\${nodeText.noSymptomCode}`	
8.	To troubleshoot this issue completely, a known-good power supply is required. Do you have immediate access to a known-good power supply?	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P02	POWER SUPPLY
9.	Substitute a known-good power supply, reassemble and retest using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Reinstall user's power supply. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P02	POWER SUPPLY
10.	Most voltage and current regulators are located on logic board. To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
11.	Substitute a known-good logic board, reassemble and retest using MRI. Does MRI still report a Vxxx or lxxx sensor test failure?	Yes	Reinstall user's logic board. Replace power supply. Verify issue resolved.	P02	POWER SUPPLY
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
12.	Identify specific type of failure reported in MRI/diagnostics: thermal sensor or fan (motor) error. MRI thermal sensors begin with Txxx. Which sensor failure does diagnostics report?	Fan (Motor)	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		Thermal	Go to step 19.	`\${nodeText.noSymptomCode}`	
13.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Refer to the service guide Functional Overview to locate affected fan connection to logic board. Disconnect fan cable connectors and inspect logic board and fan cable connector pins for damage. Is there any cable or connector damage on fan or logic board?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 16.	`\${nodeText.noSymptomCode}`	
14.	Identify whether fan, logic board, or both are damaged. Are both fan and logic board damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multipart repair.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
15.	Identify whether fan or logic board is damaged. Which part is damaged?	Fan	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		Logic Board	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M24	MLB
16.	Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does computer pass fan motor check?	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 17.	`\${nodeText.noSymptomCode}`	
17.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to a known-good fan?	Yes	Go to step 18.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
18.	Substitute a known-good fan, and retest using MRI. Does computer now pass fan motor check?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
19.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 20.	`\${nodeText.yesSymptomCode}`	
	<p>Remove display panel.</p> <p>Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does MRI still report a Txxx thermal sensor test failure?</p>	No	Issue resolved by cleaning fan and heat sink and resealing fan connections. Verify resolution.	`\${nodeText.noSymptomCode}`	
20.	Identify whether a thermal sensor that is currently failing MRI test is related to the logic board.	Yes	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M23	MLB
	Refer to service documentation for thermal sensor information and locations.	No	Go to step 21.	`\${nodeText.noSymptomCode}`	
21.	Is a logic board thermal sensor failing a test?	Yes	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	<p>Identify whether a thermal sensor that is currently failing MRI test is related to the Hard Disk Drive (HDD) or Flash Storage.</p> <p>Note: Some models do not have a HDD.</p> <p>Is a hard drive or flash storage thermal sensor failing a test?</p>	No	Go to step 26.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
22.	Verify in article SM155: Hard Drives Matrix that the installed hard drive or flash storage model is compatible with this computer configuration. Is installed HDD or flash storage compatible with this model?	Yes	Go to step 23.	`\${nodeText.yesSymptomCode}`	
		No	Unsupported HDD or Flash Storage installed, or missing/incorrect hard drive thermal sensor. Check with user for out-of-warranty resolution. Verify resolution.	`\${nodeText.noSymptomCode}`	
23.	Identify the type of storage device affected: <ul style="list-style-type: none"> • Hard Disk Drive (HDD) • Flash Storage Is the affected device an HDD or flash storage?	HDD	Go to step 24.	`\${nodeText.yesSymptomCode}`	
		Flash Storage	Replace the user's flash storage. Verify issue resolved.	H85	SSD
24.	To troubleshoot this issue completely, a known-good hard drive data cable or hard drive combo cable (depending on model) is required. Do you have immediate access to a known-good hard drive data cable or hard drive combo cable?	Yes	Go to step 25.	`\${nodeText.yesSymptomCode}`	
		No	Replace the user's hard drive. Verify issue resolved.	H85	HDD
25.	Substitute a known-good hard drive data cable or hard drive combo cable (depending on model) and retest using MRI. Does computer now pass the THxx sensor check?	Yes	Replace the user's hard drive data cable or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
		No	Reinstall user's hard drive data cable or combo cable (depending on model). Replace the user's hard drive. Verify issue resolved.	H85	HDD
26.	Identify whether a thermal sensor that is currently failing MRI test is related to the power supply. Is a power supply thermal sensor failing a test?	Yes	Replace power supply. Verify issue resolved.	P02	POWER SUPPLY
		No	Go to step 27.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
27.	<p>Identify whether a thermal sensor that is currently failing MRI test is related to the display.</p> <p>Is a display thermal sensor failing a test?</p>	Yes	Go to step 28.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multipart repair.</p>	M99	
28.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 29.	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L85	LCD
29.	<p>Substitute a known-good display panel and retest using MRI.</p> <p>Does MRI still report a TL0p or TL1p thermal sensor test failure?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multipart repair.</p>	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L85	LCD
30.	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multipart repair.</p>	M99	

Kernel Panic / System Crashes

Unlikely causes:

Battery, DisplayPort cable, hard drive power or combo cable, display panel, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Computer displays a kernel panic alert message• Computer freezes during use• Computer freezes upon wake from sleep• Computer freezes when Wi-Fi is enabled or activated <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.2. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Remember that third party software can contribute to this issue. It may be necessary to check for and apply third party updates that may not appear in the App store.3. Remove all external devices, except for a known-good USB keyboard and mouse, to help rule out peripherals as a possible cause of this issue.4. Verify memory configuration matches actual amount of installed physical memory.5. Hold Shift key during startup to put computer into safe mode. See HT201262: Use safe mode to isolate issues with your Mac.6. Follow steps outlined in article HT200553: When your computer spontaneously restarts or displays “Your computer restarted because of a problem.”7. If the issue cannot be easily reproduced, Run ASD or AST 2 extended memory tests, if available, repeatedly, to verify that the computer does not encounter a crash or kernel panic.8. If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD), refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes. <p>Warning: Be extremely careful when working inside the computer when power is applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	A voltage, current, or thermal sensor failure or an inoperative fan can cause kernel panics or system crashes. Run Macintosh Resource Inspector (MRI) or consult MRI logs to check for any sensor or fan failures. Does MRI report any sensor or fan failures?	Yes	Go to “Intermittent Shutdown” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
		No	Go to step 2.	\$(nodeText.noSymptomCode}	
2.	Reset the SMC using the procedure for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac . Then reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac . Does computer still experience crashes or kernel panics?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	Issue resolved by SMC/NVRAM reset. Verify resolution. This issue could reoccur if the cause is one of the user's external devices that was not brought in with the computer. Advise user to verify computer is functioning properly by initially leaving all external devices detached, then connecting them one at a time to confirm each device's functionality. If this issue reoccurs, the user should document which external devices are attached and bring them with the computer.	\$(nodeText.noSymptomCode}	
3.	Ask user which USB device(s) are used with computer when crashes or kernel panics occur. Does user have a USB device that may be causing crashes or kernel panics?	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	Go to step 5.	\$(nodeText.noSymptomCode}	
4.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer. Disconnect user's USB device(s). Test computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support and latest USB device information.	X99	

	Check	Result	Action	Code	Commodity
5.	<p>Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.</p> <p>Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition.</p> <p>If the iMac is internally equipped with both an HDD and SSD/flash storage, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Go to step 28.	\$(nodeText.noSymptomCode}	
6.	<p>Hold Shift key during startup to put computer into Safe Mode. See article HT201262: Use safe mode to isolate issues with your Mac.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Go to step 11.	\$(nodeText.noSymptomCode}	
7.	<p>On some models the memory is non-serviceable and can not be removed from the MLB.</p> <p>Is the memory removable from the system?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	Go to step 8.	\$(nodeText.noSymptomCode}	
8.	<p>Check to see if diagnostic LED #3 is illuminated.</p> <p>Note: Depending on computer model, this may simply require looking through the bottom air flow opening or removing the display panel.</p> <p>Is diagnostic LED #3 illuminated?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode}	
		No	Replace logic board. Verify issue resolved.	M06	MLB

	Check	Result	Action	Code	Commodity
9.	Remove installed memory modules and substitute one by one with a known-good memory module. Note: Depending on computer model, this may simply require removal of the rear door, or the removal of display panel and logic board to access the memory modules. Does computer still experience crashes or kernel panics?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode}	
		No	Isolate and replace memory module. Note: Only replace a defective memory module. There is no need to replace memory in pairs. Verify issue resolved.	X01	MEMORY
10.	Check logic board memory slots one by one, using a known-good memory module, to isolate a slot-related failure and retest. Note: Connecting an external display will permit retesting without reinstalling the internal display panel. Does crash or kernel panic occur when memory is installed in a specific slot?	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M06	MLB
		No	Go to step 11.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
11.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove wireless card and retest by testing computer with OS or diagnostics. Connect power cord to computer, wait five seconds for SMC to reset, then press power button.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 17.	\$(nodeText.yesSymptomCode}	
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
12.	<p>Inspect wireless card and logic board connectors for damage.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 16.	\$(nodeText.yesSymptomCode}	
		No	Go to step 13.	\$(nodeText.noSymptomCode}	
13.	<p>Reseat wireless card to logic board and retest with OS or diagnostics.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 14.	\$(nodeText.yesSymptomCode}	
		No	<p>Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic.</p> <p>Verify that the issue is resolved.</p>	\$(nodeText.noSymptomCode}	
14.	<p>To troubleshoot this issue completely, a known-good wireless card is required.</p> <p>Do you have immediate access to a known-good wireless card?</p>	Yes	Go to step 15.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace wireless card.</p> <p>Verify issue resolved.</p>	N13	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
15.	Substitute a known-good wireless card and retest computer with OS or diagnostics.	Yes	Replace logic board. Reinstall user's wireless card. Verify issue resolved.	M06	MLB
	Does computer still experience crashes or kernel panics?	No	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
16.	Identify whether wireless card is the only damaged component. Damage to multiple parts will require an escalation to ACS.	Yes	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
	Is damaged limited to wireless card only?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
17.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Disconnect camera/microphone/ALS cable or camera cable (depending on model) from either logic board or camera and retest computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Go to step 25.	\$(nodeText.yesSymptomCode}	
		No	Go to step 18.	\$(nodeText.noSymptomCode}	
18.	Inspect camera, camera/microphone/ALS cable or camera cable, and logic board connector for damage. Did you find any damaged components?	Yes	Go to step 24.	\$(nodeText.yesSymptomCode}	
		No	Go to step 19.	\$(nodeText.noSymptomCode}	
19.	Reseat both ends of camera/microphone/ALS cable or camera cable and retest computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Go to step 20.	\$(nodeText.yesSymptomCode}	
		No	Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic. Verify that the issue is resolved.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
20.	To troubleshoot this issue completely, a known-good camera/microphone/ALS Cable or camera cable (depending on model) is required. Do you have immediate access to a known-good camera cable?	Yes	Go to step 21.	\$(nodeText.yesSymptomCode}	
		No	Replace camera/microphone/ALS Cable or camera cable (depending on model). Verify that the issue is resolved.	X03	INTERNAL CABLE
21.	Substitute a known-good camera/microphone/ALS cable or camera cable and retest computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Go to step 22.	\$(nodeText.yesSymptomCode}	
		No	Replace camera/microphone/ALS Cable or camera cable (depending on model). Verify that the issue is resolved.	X03	INTERNAL CABLE
22.	To troubleshoot this issue completely, a known-good camera is required. Do you have immediate access to a known-good camera?	Yes	Go to step 23.	\$(nodeText.yesSymptomCode}	
		No	Replace camera. Reinstall user's camera/microphone/ALS cable or camera cable. Verify issue resolved.	X11	OTHER ELECTRIC
23.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Substitute a known-good camera and retest computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Replace logic board. Reinstall user's camera and camera/microphone/ALS or camera cable. Verify issue resolved.	M06	MLB
		No	Replace camera. Reinstall user's camera/microphone/ALS cable. Verify issue resolved.	X11	OTHER ELECTRIC
24.	Identify whether camera/microphone/ALS cable or camera cable is the only damaged component. Damage to multiple parts will require an escalation to ACS. Is damaged limited to camera/microphone/ALS cable or camera cable only?	Yes	Replace camera/microphone/ALS Cable or camera cable (depending on model). Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

	Check	Result	Action	Code	Commodity
25.	<p>Mac models may have a hard drive, SSD/flash storage, or both. If the iMac is internally equipped with both, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes.</p> <p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Disconnect hard drive data cable (or SSD/flash storage) from logic board. Connect an Ethernet cable and power cord to computer, wait five seconds for SMC to reset, then press power button. Hold down Command-Option-R keys during startup to force restart from macOS Internet recovery.</p> <p>This process may take a few minutes for computer to completely start up, depending on speed of your Internet connection. See article HT201314: About macOS Recovery for more information.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 36.	\$(nodeText.yesSymptomCode)	
		No	Go to step 26.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
26.	<p>Mac models may have a hard drive, SSD/flash storage, or both. If the iMac is internally equipped with both, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes. To support Fusion Drive functionality, a known-good HDD and SSD/flash storage should be used.</p> <p>To completely troubleshoot this issue, the following known-good parts are required:</p> <ul style="list-style-type: none"> • Hard drive or SSD/flash storage • Hard drive data cable or combo cable (depending on model) <p>For a Fusion Drive computer, the following known-good parts are required:</p> <ul style="list-style-type: none"> • Hard drive and paired SSD/flash storage • Hard drive data cable or combo cable (depending on model) <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 30.	\$(nodeText.yesSymptomCode}	
		No	Go to step 27.	\$(nodeText.noSymptomCode}	
27.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reconnect hard drive data cable (or SSD/flash storage) to logic board.</p> <p>Hold down Command-R during startup to restart from the recovery partition and use Disk Utility to repair user's hard drive or SSD/flash storage. If disk repair is successful, restart and test user's OS.</p> <p>Was Disk Utility repair successful and is crash/kernel panic issue resolved?</p>	Yes	Issue resolved after Disk Utility repair. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Go to step 28.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
28.	Restore macOS on user's hard drive or SSD/flash storage. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Does computer still experience crashes or kernel panics?	Yes	Go to step 29.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved after reinstalling macOS. Verify resolution.	\$(nodeText.noSymptomCode)	
29.	Identify the type of storage device affected: <ul style="list-style-type: none">• Hard disk drive (HDD)• Flash storage / solid-state drive (SSD) Is the affected device an HDD or SSD?	HDD	Replace the user's hard drive. Verify issue resolved.	H02	HDD
		SSD	Replace the user's SSD/flash storage. Verify issue resolved.	H02	SSD
30.	iMacs equipped with both a hard disk drive (HDD) and solid-state drive (SSD) / flash storage ship as a Fusion Drive configuration. Refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes. Is computer configured as a Fusion Drive?	Yes	Go to step 35.	\$(nodeText.yesSymptomCode)	
		No	Go to step 31.	\$(nodeText.noSymptomCode)	
31.	iMac may be equipped with either a hard drive or SSD/flash storage. Identify which type of storage device is installed. Is computer equipped with a hard drive or with a SSD/flash storage card?	Hard Drive	Go to step 33.	\$(nodeText.yesSymptomCode)	
		SSD/Flash Storage	Go to step 32.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
32.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute known-good SSD/flash storage with an up-to-date, bootable version of macOS installed. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Replace logic board. Reinstall user's SSD/flash storage. Verify issue resolved.	M06	MLB
		No	Replace user's SSD/flash storage. Verify issue resolved.	H02	SSD
33.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive with an up-to-date, bootable version of macOS installed. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 34.	\$(nodeText.yesSymptomCode)	
		No	Replace user's hard drive. Verify issue resolved.	H02	HDD
34.	<p>Continue using known-good hard drive. Substitute a known-good hard drive data cable or combo cable (depending on model) between drive and logic board, and retest computer with OS.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Replace logic board. Reinstall user's hard drive (or/and SSD/flash storage) and data cable or combo cable. Verify issue resolved.	M06	MLB
		No	Replace hard drive data cable or combo cable (depending on model). Reinstall user's hard drive. Verify issue resolved.	X03	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
35.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive and SSD/flash storage paired as a Fusion Drive with an up-to-date, bootable version of macOS installed. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 34.	\$(nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
36.	<p>Restart computer from Apple Service Toolkit (AST) server by pressing N key on startup.</p> <p>Use extended version of Cooling System Diagnostics (CSD) to verify proper function of the following subsystems:</p> <ul style="list-style-type: none"> • SMC • Fan • Thermal sensors • CPU–heat sink thermal interface <p>Does computer pass all CSD checks?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	Go to step 37.	\$(nodeText.noSymptomCode}	
37.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect fan and heat sink fin stack. Partial disassembly of computer is required to access fan and heat sink. Use an ESD-safe vacuum to remove any dust or debris. Reassemble and retest using CSD.</p> <p>Does computer pass all CSD checks?</p>	Yes	Issue resolved by cleaning airflow. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Go to step 38.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
38.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to known-good fan?	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
39.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Substitute a known-good fan and retest using CSD. Does computer now pass CSD tests?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Go to step 40.	\$(nodeText.noSymptomCode)	
40.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 41.	\$(nodeText.yesSymptomCode)	
		No	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB
41.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Continue to use known-good fan. Substitute a known-good logic board. Reassemble computer and retest with MRI and CSD. Do both known-good fan and logic board pass MRI and CSD tests?	Yes	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
42.	Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

No Power

Unlikely causes:

Camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data or power or combo cable, display panel, left speaker, memory, right speaker, solid-state drive (SSD)/Flash storage card, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Computer does not turn on• Computer does not turn off• No image on internal or external displays• No startup sound (not available on some models)• No sounds from fan or hard drive (if hard drive present)• No Caps Lock LED when key is pressed on wired keyboard• Non-operational <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Verify AC power source.2. Disconnect all peripherals.3. Verify user's power cord.4. Determine whether computer is in power-on state by checking for all of the following:<ul style="list-style-type: none">• Caps Lock LED on wired keyboard• Fan spinning sound• Startup sound (not available on some models)• Hard drive spin (if hard drive present)• Display backlight on• External display activity• Thunderbolt disk mode operation5. Follow suggested steps in HT204267: If your Mac won't turn on.6. Reset SMC using the procedure listed in article HT201295: Resetting the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	The user may report that the computer will not turn off or the computer will not turn on (no power). Which issue is the user experiencing?	Will Not Turn Off	Go to step 22.	\$(nodeText.yesSymptomCode)	
		No Power	Go to step 2.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	Press power button to start up computer. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound (not available on some models), or Caps Lock LED on wired keyboard. Does computer show any signs of power activity?	Yes	Go to step 16.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Inspect user's power cord for wire or connector damage. Also inspect computer AC inlet for signs of arcing or damaged pins, which could affect power cord connections. Did you find any damaged components?	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
4.	Determine whether damage affects user's power cord, AC inlet, or both. Is damage limited to power cord only?	Yes	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
5.	Verify that user's power cord is securely plugged into a known-good, grounded electrical outlet that provides adequate voltage and power to operate computer. Ensure power cord is fully seated to AC inlet. Attempt to turn on computer. Does issue persist with known-good power cord?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to step 16.	\$(nodeText.noSymptomCode)	
6.	Substitute a known-good power cord and attempt to turn on computer. Does issue persist with known-good power cord?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
7.	Reset SMC using the procedure listed for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac .	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
	<ol style="list-style-type: none"> 1. Press and hold power button a little more than 10 seconds to force SMC to turn off computer from an unknown power state. 2. Disconnect power cord and wait 15 seconds with power cord removed to reset SMC. 3. Attach computer's power cord, making sure power button is not being pressed. 4. Wait five seconds, then press power button to turn on computer. <p>Does issue persist after SMC reset?</p>	No	Issue resolved after SMC reset. Verify resolution.	\$(nodeText.noSymptomCode)	
8.	Remove AC power cord and allow time for power supply to discharge before opening computer for repair.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
	<p>Remove display panel to inspect and reseal:</p> <ul style="list-style-type: none"> • AC inlet power to power supply • DC power cable between power supply and logic board • Power button cable to power supply <p>Inspect wires and connectors, looking for pinched or exposed wire, and burnt or damaged connectors and pins.</p> <p>Did you find any damaged components?</p>	No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
9.	Determine whether damage affects DC power cable only, or additional components such as power supply or logic board connectors. Multiple damaged parts requiring replacement will be escalated to ACS.	Yes	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P16	POWER SUPPLY
	Is damage limited to DC power cable only?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
10.	Connect power cord to computer, wait five seconds for SMC to set, then press power button. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound (not available on some models), or Caps Lock LED on wired keyboard. Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips, refer to articles: <ul style="list-style-type: none">• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety	Yes	Go to step 16.	\$(nodeText.yesSymptomCode}	
	Does computer show any signs of power activity?	No	Go to step 11.	\$(nodeText.noSymptomCode}	
11.	Disconnect the wireless card from the logic board.	Yes	Replace wireless card. Verify issue resolved.	N01	WIRELESS DEVICE
	Attempt normal startup. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound (not available on some models), or Caps Lock LED on wired keyboard. Does computer show any signs of power activity?	No	Go to step 12.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
12.	<p>Locate diagnostic LEDs on logic board. With AC power cord connected to computer, verify whether diagnostic LED #1 is on, indicating power supply is providing power to SMC and logic board.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Is diagnostic LED #1 on?</p>	Yes	Go to step 13.	\$(nodeText.yesSymptomCode}	
		No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
13.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Disconnect power button cable from power supply to inspect cable and connector for damage. Using a multimeter set as ohm meter, verify continuity between the two pins of the power button when it is pressed. A properly working power button should be open when button is released.</p> <p>For additional information on using a multimeter, see article HT3250: Using a digital multimeter.</p> <p>Does power button have continuity when button is pressed and open when released?</p>	Yes	Go to step 14.	\$(nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Replace the rear enclosure which includes the power button and cable. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X14	

	Check	Result	Action	Code	Commodity
14.	Reconnect power button cable to power supply. Connect power cord to computer, wait five seconds for SMC to set, then press power button to start up computer. Verify whether diagnostic LED #2 is on soon after power button is pressed. This indicates that power to start up computer is on.	Yes	Go to step 15.	\$(nodeText.yesSymptomCode)	
	Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.	No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
	Are both diagnostic LED #1 and LED #2 on?				
15.	Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound (not available on some models), or Caps Lock LED on wired keyboard.	Yes	Go to step 16.	\$(nodeText.yesSymptomCode)	
	Does computer show any signs of power activity?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
16.	Verify whether a video signal appears on display.	Yes	Run Mac Resource Inspector (MRI) to obtain latest test results. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
	Is a video image clearly visible on display?	No	Go to step 17.	\$(nodeText.noSymptomCode)	
17.	On a display with dim or no backlight, shine a bright flashlight onto front of display while carefully checking for a faint image showing graphics, an Apple logo, open windows, or other signs that the system is partially functional.	Yes	Go to “Backlight Issue / No Backlight” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Is any video visible with flashlight?	No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
18.	To continue to troubleshoot this issue, a known-good power supply is required.	Yes	Go to step 19.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good power supply?	No	Go to step 20.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
19.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Substitute a known-good power supply and attempt to turn on computer.</p> <p>Does computer show any signs of power activity?</p>	Yes	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
		No	Go to step 20.	\$(nodeText.noSymptomCode)	
20.	<p>Measure the logic board coin battery voltage.</p> <p>Refer to the service guide 'Diagnostic LEDs and Test Pads' article for information about locating the RTC battery measurement test pads.</p> <p>Carefully touch one multimeter probe to each pad to measure an expected coin battery voltage of 3 volts DC.</p> <p>If the voltage is 2.7 VDC or less, replace the coin battery.</p> <p>For additional information on using a multimeter, see article HT3250: Using a digital multimeter.</p> <p>Is the coin battery voltage low (2.7 VDC or less)?</p>	Yes	<p>Replace coin cell battery.</p> <p>Note: Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery is no longer available to order via GSX. Please order this battery from an electronics parts distributor.</p> <p>Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.</p> <p>Verify that the issue is resolved.</p>	X32	OTHER ELECTRIC
		No	Go to step 21.	\$(nodeText.noSymptomCode)	
		Yes	Issue resolved by resetting logic board. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Important: Remove AC power to computer and wait two minutes.</p> <p>Force-reset the logic board Real-Time Clock (RTC) using one of the procedures listed below, and refer to corresponding link for exact location of reset pads for this computer. Be extra careful not to touch any other components to avoid damaging logic board.</p> <p>Warning: Do not short-circuit the reset pads for more than a few seconds, as doing so may cause damage to coin battery and/or logic board.</p> <ol style="list-style-type: none"> Small flat-blade screwdriver: Gently touch flat edge of the tip of the blade to both pads simultaneously. Torx T-10 screwdriver: Holding 				

21.	<p>screwdriver vertically, bridge the flat surface of the tip across both reset pads.</p> <p>3. Two small metal jeweler's screwdrivers: Touch the tip of each screwdriver to each reset pad, then cross the shanks of the two screwdrivers and touch them together briefly.</p> <p>Refer to the service guide 'Diagnostic LEDs and Test Pads' article for information about locating the RTC reset test pads.</p> <p>Connect power cord to computer, wait five seconds for SMC to set, then press power button. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound (not available on some models), or Caps Lock LED on wired keyboard.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>Does computer show any signs of power activity?</p>	No	Replace logic board. Verify issue resolved.	M01	MLB
22.	<p>If any app hangs or freezes when the computer is shutting down, then try to force quit that app. Also check if any software updates are in progress.</p> <p>Does the computer turn off?</p>	Yes	Issue resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 23.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
23.	Press and hold down the power button for 10 seconds or until user's computer powers off. Does the computer turn off?	Yes	Go to step 24.	\$(nodeText.yesSymptomCode)	
		No	Go to step 25.	\$(nodeText.noSymptomCode)	
24.	Reset SMC using the procedure listed for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac . 1. Press and hold power button a little more than 10 seconds to force SMC to turn off computer from an unknown power state. 2. Disconnect power cord and wait 15 seconds with power cord removed to reset SMC. 3. Attach computer's power cord, making sure power button is not being pressed. 4. Wait five seconds, then press power button to turn on computer. Does issue persist after SMC reset?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved after SMC reset. Verify resolution.	\$(nodeText.noSymptomCode)	
25.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel to inspect and reseat: <ul style="list-style-type: none"> AC inlet power to power supply DC power cable between power supply and logic board Power button cable to power supply Inspect wires and connectors, looking for pinched or exposed wire, and burnt or damaged connectors and pins. Did you find any damaged components?	Yes	Go to step 26.	\$(nodeText.yesSymptomCode)	
		No	Go to step 27.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
26.	Determine whether damage affects power button cable only from main logic board to rear enclosure, or additional components such as power supply or logic board connectors. Multiple damaged parts requiring replacement will be escalated to ACS.	Yes	Replace the rear enclosure which includes the power button and cable. Verify that the issue is resolved.	X03	ENCLOSURE
	Is damage limited to power button cable only?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
27.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	No failure found during diagnostic testing. Using correct positioning, return computer to user with no trouble found. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
	Disconnect power button cable from power supply to inspect cable and connector for damage. Using a multimeter set to read ohms, verify continuity between the two pins of the power button when it is pressed. A properly working power button should be open when button is released. For additional information on using a multimeter, see article HT3250: Using a digital multimeter . Does power button have continuity when button is pressed and open when released?	No	ESCALATION REQUIRED. Replace the rear enclosure which includes the power button and cable. Verify issue resolved. Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty . Contact ACS for additional support regarding warranty coverage for this part.	X14	
28.	Verify that computer can now complete startup process over multiple trials.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Will Not Start Up

Unlikely causes:

Camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, left speaker, power supply, rear enclosure, right speaker, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • No startup sound (not available on some models) or POST (Power-On Self-Test) • Gray screen appears during startup • Some video activity, Apple logo, spinning gear • Prohibitory sign or folder with a flashing question mark • Error beep tones • Audible fan, hard drive spin (if present), or optical drive reset sounds • Caps Lock LED on wired keyboard toggles on and off when pressed <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> 1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery. 2. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Remember that third party software can contribute to this issue. It may be necessary to check for and apply third party updates that may not appear in the App store. 3. Verify that startup process passes initial memory checks and POST (Power-On Self-Test) with a normal startup sound (not available on some models) and with some video activity. If computer generates beeping sounds, there may be an issue with memory. See article HT201702: Intel-based Mac Power-On Self-Test RAM error codes. 4. Remove all external devices, except for a known-good USB keyboard and mouse, to help rule out peripherals as a possible cause of this issue. 5. Follow suggested steps in HT204267: If your Mac won't turn on. 6. Verify memory configuration matches actual amount of installed physical memory. 7. Hold Shift key during startup to put computer into safe mode. See HT201262: Use safe mode to isolate issues with your Mac. 8. Reset SMC using the procedure listed for this computer in article HT201295: Intel-based Macs: Resetting the System Management Controller (SMC) to return computer to a known power-off state. Try to turn on from power-off state. 9. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 10. Run Disk Utility or check Mac Resource Inspector (MRI) results to verify presence and SMART status of user's hard drive (HDD) or solid-state drive (SSD)/flash storage card. iMac models may have a hard drive or SSD/flash storage card, or both. 11. Identify when during startup process computer hangs in order to isolate the issue. See article HT204156: About the screens you see when your Mac starts up. 12. If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD)/flash storage card, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac .	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	A memory error is indicated by a sequence of one or three beep tones. Refer to article HT201702: Intel-based Mac Power-On Self-Test RAM error codes for more information. Does computer make error beep tones at startup?	No	Go to step 17.	`\${nodeText.noSymptomCode}`	
2.	Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac .	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
	A memory error is indicated by a sequence of one or three beep tones. Refer to article HT201702: Intel-based Mac Power-On Self-Test RAM error codes for more information. Does computer make error beep tones at startup?	No	Go to step 18.	`\${nodeText.noSymptomCode}`	
3.	Reseat all memory modules securely in their slots and retest.	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
	Does computer make error beep tones at startup?	No	Issue resolved. Verify resolution.	`\${nodeText.noSymptomCode}`	
4.	Some iMac models have four memory slots and may have up to four memory modules to test.	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
	Does this computer have four memory slots?	No	Go to step 5.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
	<p>Remove display panel.</p> <p>Remove logic board to access memory slots. Remove user's memory module from the first slot and substitute a known-good memory module into same slot. Reinstall logic board and display panel (without VHB foam layers) and retest.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>Does computer indicate a memory error with one known-good module and one user module?</p>	No	<p>Replace defective memory.</p> <p>Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
6.	Keep known-good memory module in the first slot and substitute second slot module with a second known-good memory module. Retest.	Yes	Replace logic board. Verify issue resolved.	M07	MLB
	Does computer indicate a memory error using two known-good memory modules?	No	Go to step 7.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	Install first user memory module in first memory slot and test with a known-good memory module in second slot.	Yes	Replace both memory modules. Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple. Verify issue resolved.	X02	MEMORY
	Does computer indicate a memory error?	No	Replace defective memory. Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple. Verify issue resolved.	X02	MEMORY
8.	Typical configurations ship with two memory modules located in first two slots. It is possible to see a configuration with four memory modules installed.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	Is user's computer configured with four memory modules installed?	No	Go to step 14.	`\${nodeText.noSymptomCode}`	
9.	Keep track of where memory is located as you work in pairs to isolate memory and later verify slot functionality. Remove user memory from second two slots and retest.	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
	Does computer indicate a memory error with user memory in first two slots only?	No	Go to step 10.	`\${nodeText.noSymptomCode}`	
10.	Leave user memory installed in first two slots. Install two known-good memory modules in second two slots and retest.	Yes	Replace logic board. Verify issue resolved.	M07	MLB
	Does computer indicate a memory error with known-good memory in second two slots?	No	Go to step 11.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
11.	<p>Leave the two installed known-good memory modules in second two slots. Remove user memory from first two slots and set aside as proven good user memory. Install user memory originally removed from second two slots and place this memory into proven good first two slots. Retest.</p> <p>Does computer indicate a memory error with user memory in first two slots?</p>	Yes	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 12.	`\${nodeText.noSymptomCode}`	
12.	<p>Remove known-good memory from second two slots, leaving user memory (originally from second two slots) in first two slots. Install previously proven good user memory (originally from first two slots) into second two slots. Restart computer to verify user memory that has been reversed from original first two and second two slot configuration.</p> <p>Does computer indicate a memory error with user memory?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support. Situation - user memory passes test when paired with known-good memory but fails when paired with like user memory.</p>	M99	
		No	Issue resolved with memory reconfiguration, memory/slot reseat. Verify resolution.	`\${nodeText.noSymptomCode}`	
13.	<p>Remove known-good memory from second two slots, leaving user memory in first two slots. Restart computer to verify user memory in first two slots as standalone with no memory in second two slots.</p> <p>Does computer indicate a memory error with user memory in first two slots only?</p>	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support. Situation: User memory (currently located first two slots) fails when paired with known-good memory and passes when known-good memory is removed from adjacent slots.</p>	M99	

	Check	Result	Action	Code	Commodity
14.	<p>Remove user memory module from first slot and substitute a known-good memory module into same first slot. Retest.</p> <p>Does computer indicate a memory error with one known-good and one user module in first two slots?</p>	Yes	Go to step 15.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace defective memory.</p> <p>Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
15.	<p>Keep known-good memory module in first slot and substitute second slot module with a second known-good memory module. Keep track of suspect user memory removed from second slot. Testing both first two slots with known-good memory will verify error is either defective slots or defective memory.</p> <p>Does computer indicate a memory error using two known-good memory modules in first two slots?</p>	Yes	Replace logic board. Verify issue resolved.	M07	MLB
		No	Go to step 16.	`\${nodeText.noSymptomCode}`	
16.	<p>Install first user memory module (removed from first slot) into second memory slot and test paired with a known-good memory module still in first slot.</p> <p>Does computer indicate a memory error?</p>	Yes	<p>Replace both user memory modules in first two slots.</p> <p>Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
		No	<p>Replace defective memory.</p> <p>Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY

	Check	Result	Action	Code	Commodity
17.	Check to see if diagnostic LED #3 is illuminated.	Yes	Go to step 18.	`\${nodeText.yesSymptomCode}`	
	<p>Note: Depending on computer model, this may require either simply looking through the bottom air flow opening or removing the display panel.</p> <p>Is the diagnostic LED #3 illuminated?</p>	No	Replace logic board. Verify issue resolved.	M06	MLB
18.	Observe startup process to verify computer gets to initial gray screen after startup sound.	Yes	Go to step 19.	`\${nodeText.yesSymptomCode}`	
	Does computer reach a gray screen during startup process?	No	Go to "Power But Blank/No Video" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
19.	Verify that computer completes full startup process: Startup sound (not available on some models) > gray screen > Apple logo > spinning gear > login screen > user's desktop.	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Does computer complete startup process to user's desktop?	No	Go to step 20.	`\${nodeText.noSymptomCode}`	
20.	Start up computer and determine whether a kernel panic is occurring.	Yes	Go to "Kernel Panic/System Crashes" troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Does computer display a kernel panic during startup?	No	Go to step 21.	`\${nodeText.noSymptomCode}`	
21.	Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: macOS: About macOS Recovery .	Yes	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	Does computer start up from recovery partition?	No	Go to step 25.	`\${nodeText.noSymptomCode}`	
22.	Use a Fusion Drive-capable version of Disk Utility, Mac Resource Inspector (MRI), AST Storage Diagnostic, or Apple Service Diagnostic (ASD) to determine whether the user's HDD/SSD/flash storage is recognized, and SMART status is verified.	Yes	Go to step 23.	`\${nodeText.yesSymptomCode}`	
	Is user's HDD/SSD/flash storage detected and SMART status verified?	No	Go to "HDD/SSD/Flash Storage Not Recognized / Not Mounting / Read/Write Issues" troubleshooting flow.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
23.	<p>If the iMac is internally equipped with both an HDD and SSD/flash storage, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes.</p> <p>Refer to HT204319: macOS versions and builds included with Mac computers and use Disk Utility or MRI to determine if the user's HDD/SSD/flash storage has the correct system build for this computer model.</p> <p>Is correct version/build of macOS installed on user's hard drive/SSD/flash storage?</p>	Yes	Go to step 24.	`\${nodeText.yesSymptomCode}`	
		No	Restore correct version and build of macOS according to article HT204319: macOS versions and builds included with Mac computers . Verify issue resolved.	`\${nodeText.noSymptomCode}`	
24.	<p>Run Disk Utility from the recovery partition to repair the user's HDD/SSD/flash storage. Attempt to start up from the user's HDD/SSD/flash storage.</p> <p>Does computer start up successfully from user's HDD/SSD/flash storage?</p>	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Restore correct version and build of macOS according to article HT204319: macOS versions and builds included with Mac computers . Verify issue resolved.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
25.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Disconnect hard drive power and data cables (or hard drive combo cable, depending on model) at the hard drive. Remove SSD/flash storage card, if present. In order to verify the startup process with the display panel removed, connect an external display.</p> <p>Connect power cord to computer, wait five seconds for SMC to reset, then press power button. Hold down Command-Option-R keys during startup to force restart from macOS Internet Recovery over NetBoot. See article HT201314: macOS: About macOS Recovery.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>Does computer start up from macOS Internet Recovery?</p>	Yes	Go to step 26.	<code>\${nodeText.yesSymptomCode}</code>	
		No	Go to step 38.	<code>\${nodeText.noSymptomCode}</code>	
26.	<p>To troubleshoot this issue completely, a known-good HDD or SSD/flash storage (depending on computer configuration) is required.</p> <p>Do you have immediate access to a known-good HDD/SSD/flash storage?</p>	Yes	Go to step 27.	<code>\${nodeText.yesSymptomCode}</code>	
		No	Go to step 30.	<code>\${nodeText.noSymptomCode}</code>	
27.	<p>Substitute known-good HDD/SSD/flash storage. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.</p> <p>Does computer start up with known-good HDD/SSD/flash storage?</p>	Yes	Go to step 28.	<code>\${nodeText.yesSymptomCode}</code>	
		No	Go to step 30.	<code>\${nodeText.noSymptomCode}</code>	

	Check	Result	Action	Code	Commodity
28.	<p>If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD) / flash storage, refer to article HT202574: Mac mini (Late 2012 and later), iMac (Late 2012 and later): About Fusion Drive for specific troubleshooting and restore processes.</p> <p>Is user's computer configured with a Fusion Drive?</p>	Yes	Go to step 30.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 29.	`\${nodeText.noSymptomCode}`	
29.	<p>Identify the type of storage device affected:</p> <ul style="list-style-type: none"> • Hard disk drive (HDD) • Flash storage/solid-state drive (SSD) <p>Is the affected device an HDD or SSD?</p>	HDD	Replace the user's hard drive. Verify issue resolved.	H02	HDD
		SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H02	SSD
30.	<p>Reseat and inspect hard drive power cable or hard drive combo cable (depending on model). Look for damaged wires, and pin or connector housing damage.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 32.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 31.	`\${nodeText.noSymptomCode}`	
31.	<p>Identify the type of storage device affected:</p> <ul style="list-style-type: none"> • Hard disk drive (HDD) • Flash storage/solid-state drive (SSD) <p>Is the affected device an HDD or SSD?</p>	HDD	Go to step 33.	`\${nodeText.yesSymptomCode}`	
		SSD	Go to step 36.	`\${nodeText.noSymptomCode}`	
32.	<p>Multiple-component damage requires an escalation to ACS for multipart replacement.</p> <p>Is damage limited to hard drive power cable or hard drive combo cable only?</p>	Yes	<p>Replace hard drive power cable or hard drive combo cable (depending on model). Reinstall user's hard drive. Verify issue resolved.</p>	X03	INTERNAL CABLE
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

	Check	Result	Action	Code	Commodity
33.	With hard drive power cable or hard drive combo cable reseated, turn on computer and verify hard drive disc spins up. Does hard drive seem to be spinning as expected?	Yes	Go to step 34.	`\${nodeText.yesSymptomCode}`	
		No	Replace hard drive power cable or hard drive combo cable (depending on model). Reinstall user's hard drive. Verify issue resolved.	X03	INTERNAL CABLE
34.	To troubleshoot this issue completely, a known-good hard drive data cable or hard drive combo cable (depending on model) is required. Do you have immediate access to a known-good hard drive data cable or hard drive combo cable?	Yes	Go to step 35.	`\${nodeText.yesSymptomCode}`	
		No	Replace the user's hard drive. Verify issue resolved.	H02	HDD
35.	Substitute a a known-good hard drive data cable or hard drive combo cable (depending on model) and retest. Does computer start up with known-good hard drive data cable or hard drive combo cable?	Yes	Replace the user's hard drive data cable or hard drive combo cable (depending on model). Reinstall user's hard drive. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 36.	`\${nodeText.noSymptomCode}`	
36.	At this point in the troubleshooting process, you may be using the user's HDD/SSD/flash storage or a known-good HDD/SSD/flash storage. Which storage device type is currently installed?	User's HDD/SSD/flash storage	Go to step 37.	`\${nodeText.yesSymptomCode}`	
		Known-Good HDD/SSD/flash storage	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
37.	Identify the type of storage device affected: <ul style="list-style-type: none">• Hard disk drive (HDD)• Flash storage/solid-state drive (SSD) Is the affected device an HDD or SSD?	HDD	Replace the user's hard drive. Reinstall user's hard drive data cable or hard drive combo cable. Verify issue resolved.	H02	HDD
		SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H02	SSD

	Check	Result	Action	Code	Commodity
38.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove wireless card from logic board. Reconnect hard drive power and data cables (or hard drive combo cable, depending on model) to the hard drive. Reconnect SSD/flash storage card, if present.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button. Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See article HT201314: macOS: About macOS Recovery.</p> <p>Does computer start up from recovery partition?</p>	Yes	Go to step 39.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 44.	`\${nodeText.noSymptomCode}`	
39.	Inspect wireless card edge connector on logic board for bent pins or housing damage.	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	Is logic board connector damaged?	No	Go to step 40.	`\${nodeText.noSymptomCode}`	
40.	<p>Inspect wireless card for damage. Verify clean contact on card edge connector, no soot from electrical short, no broken antenna connections, proper heat transfer pad attached, and a flat surface overall. Confirm no bending or broken printed circuit board or EMI shield.</p> <p>Is wireless card damaged?</p>	Yes	Replace the wireless card. Verify issue resolved.	N17	WIRELESS DEVICE
		No	Go to step 41.	`\${nodeText.noSymptomCode}`	
41.	<p>Reseat wireless card connection to logic board.</p> <p>Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See article HT201314: macOS: About macOS Recovery.</p> <p>Does computer start up from recovery partition?</p>	Yes	Issue resolved by reseating wireless card. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 42.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
42.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 43.	#{nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good wireless card?	No	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
43.	Substitute a known-good wireless card.	Yes	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
	Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See article HT201314: macOS: About macOS Recovery . Verify that Wi-Fi is present. Does computer start up from recovery partition?	No	Replace logic board. Reinstall user's wireless card. Verify issue resolved.	M02	MLB
44.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Measure the logic board coin battery voltage.</p> <p>Refer to the service guide 'Diagnostic LEDs and Test Pads' article for information about locating the RTC battery measurement test pads.</p> <p>Carefully touch one multimeter probe to each pad to measure an expected coin battery voltage of 3 volts DC.</p> <p>If the voltage is 2.7 VDC or less, replace the coin battery.</p> <p>For additional information on using a multimeter, see article HT3250: Using a digital multimeter.</p> <p>Is the coin battery voltage low (2.7 VDC or less)?</p>	Yes	<p>Replace coin cell battery.</p> <p>Note: Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery is no longer available to order via GSX. Please order this battery from an electronics parts distributor.</p> <p>Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.</p> <p>Verify that the issue is resolved.</p>	X32	OTHER ELECTRIC
		No	Go to step 45.	#{nodeText.noSymptomCode}	
	Important: Remove AC power to computer and wait two minutes.	Yes	Issue resolved by resetting the logic board. Verify resolution.	#{nodeText.yesSymptomCode}	
	Force-reset the logic board Real-Time Clock (RTC) using				

	<p>one of the procedures listed below, and refer to corresponding link for exact location of reset pads for this computer. Be extra careful not to touch any other components to avoid damaging logic board.</p> <p>Caution: Do not short-circuit the reset pads for more than a few seconds, as doing so may cause damage to coin battery and/or logic board.</p> <ol style="list-style-type: none"> 1. Small flat-blade screwdriver: Gently touch flat edge of the tip of the blade to both pads simultaneously. 2. Torx T-10 screwdriver: Holding screwdriver vertically, bridge the flat surface of the tip across both reset pads. 3. Two small metal jeweler's screwdrivers: Touch the tip of each screwdriver to each reset pad, then cross the shanks of the two screwdrivers and touch them together briefly. 				
45.	<p>Refer to the service guide 'Diagnostic LEDs and Test Pads' article for information about locating the RTC reset test pads.</p> <p>Connect power cord to computer, wait five seconds for SMC to set, then press power button.</p> <p>Verify that computer completes full startup process: Startup sound (not available on some models) > gray screen > Apple logo > spinning gear > login screen > user's desktop.</p> <p>Warning: Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety 	No	Replace logic board. Verify issue resolved.	M02	MLB

	Does computer complete startup process to user's desktop?				
46.	Verify that computer can now complete startup process over multiple trials.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED.	X99	
	Verify that the issue is resolved.		Contact ACS for additional support or a multiple-part repair.		
	Is the issue resolved?				

Required Tools

Required Tools for iMac (Late 2012 – 2017) and iMac Pro (2017) Models

The following tools are required to service these models:

- iMac Pro (2017)
- iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)
- iMac (27-inch, Late 2012 and Late 2013)
- iMac (Retina 4K, 21.5-inch, Late 2015 and 2017)
- iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014, Late 2015, 2017)

For more information about tools, refer to article [OP101: Apple notebooks and desktops: Hand Tools for Repairs](#).

General Tools

- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD bags, to store ESD-sensitive parts while removed from the computer
- ESD-safe tweezers.
- Black stick or other nonconductive nylon or plastic flat-bladed tool
 - Black stick, pack of 4 (922-5065)
 - Black stick, pack of 24 (922-9004)
 - Black stick, pack of 96 (922-9005)
- Digital volt meter, for troubleshooting
- Earphones, for audio cable reassembly
- Kapton tape
- Magnifying glass, for reading the serial number
- Pentalobe driver (923-0367), for VESA mount
- Phillips #00 screwdriver
- Sticky notes
- Thunderbolt and USB cables, for logic board replacement
- Torx T4 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)
- Torx T10 screwdriver (magnetized)
- Torx T25 screwdriver (magnetized), for 27-inch models
- Adjustable torque driver 0.3–1.2 Nm (923-0735)
- T8 security bit (923-0734)
- Logic Board Service Tray (076-00376)
- Phillips PH2 bit
- Access Card for iMac Pro (923-02298)

Display Tools

The display is secured to the rear enclosure using adhesive strips. When a repair requires the removal of the display panel, the very high bond (VHB) adhesive strips must be cut and replaced.

Display starter kit and refill kits

Model	Starter kit	Refill kit
iMac (21.5-inch, Late 2012)	076-1444	076-1437
iMac (21.5-inch, Early 2013)	076-1444	076-1437
iMac (21.5-inch, Late 2013)	076-1444	076-1437
iMac (21.5-inch, Mid 2014)	076-1444	076-1437
iMac (21.5-inch, Late 2015)	076-1444	076-1437
iMac (21.5-inch, 2017)	076-00330	076-00331
iMac (Retina 4K, 21.5-inch, Late 2015)	076-1444	076-1437
iMac (Retina 4K, 21.5-inch, 2017)	076-00330	076-00331
iMac (27-inch, Late 2012)	076-1444	076-1419
iMac (27-inch, Late 2013)	076-1444	076-1419
iMac (Retina 5K, 27-inch, Late 2014)	076-1444	076-00009
iMac (Retina 5K, 27-inch, Mid 2015)	076-1444	076-00009
iMac (Retina 5K, 27-inch, Late 2015)	076-1444	076-00009
iMac (Retina 5K, 27-inch, 2017)	076-00330	076-00332
iMac Pro (2017)	076-00374	076-00375

Display starter kit contains:

- Display removal tool (1) (the white handle shown here), also available separately as 076-00108
- Display removal wheels (8) (the black circle on the left side of tool shown here)

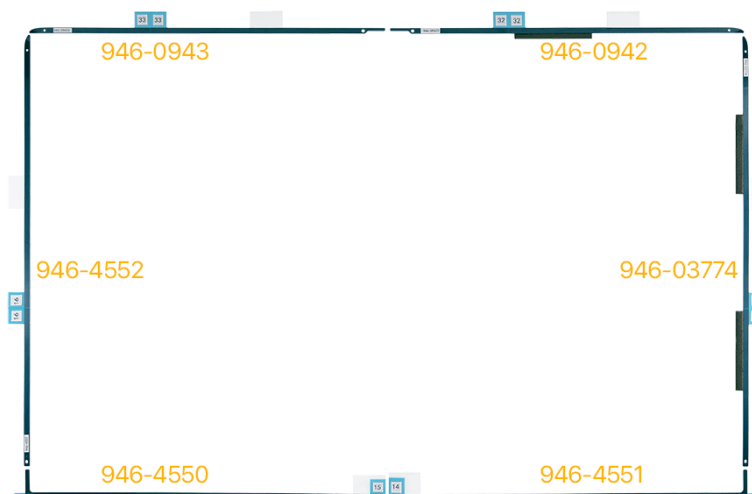


- iMac service foam locking wedge (not available separately)

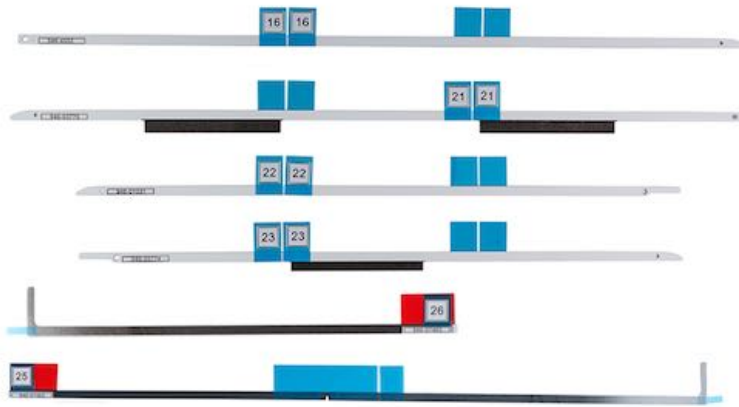
Note: The number on the side of the foam wedge (944-4365) is an Apple internal part number used for identification. It is not an orderable service part.



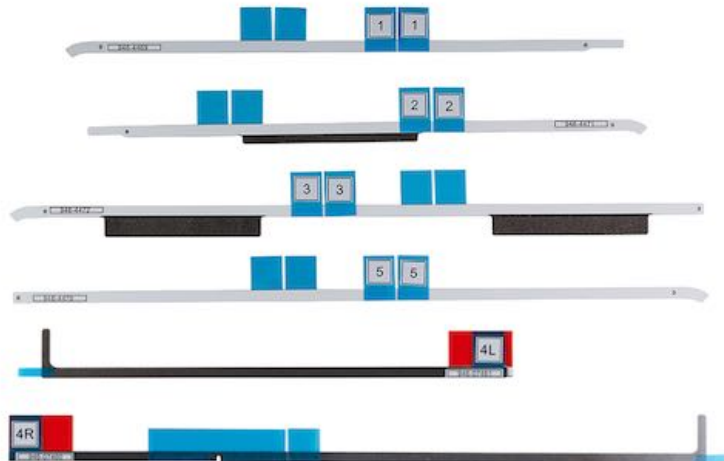
- VHB adhesive strip 6-piece set for iMac Pro (2017)



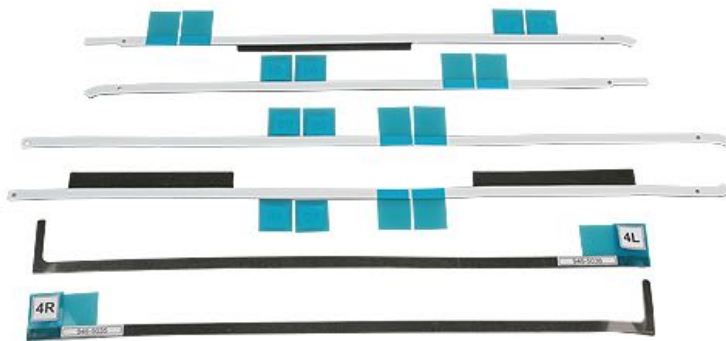
- VHB adhesive strip 6-piece set for iMac (27-inch, 2017) (4 sets)



- VHB adhesive strip 6-piece set for iMac (21.5-inch, 2017) (4 sets)



- VHB adhesive strip 6-piece set for iMac (21.5-inch, Late 2012–Mid 2015 models)



Display refill kits contain:

- Display removal tool (1), also available separately as 076-00108
- Display removal wheels (20), also available separately as 076-1417
- VHB adhesive strip 6-piece set (20 sets)

Other display tools:

- Display cable extension kit, to test the display panel and cables with the display panel removed
 - 076-1428 for iMac (21.5-inch, Late 2012–2017 models)
 - 076-00200 for iMac (Retina 4K and 2.8 GHz, 21.5-inch, Late 2015)
 - 076-1431 for iMac (27-inch, Late 2012 and Late 2013)
 - 076-00010 for iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017) models, iMac (Retina 4K, 21.5-inch, 2017), and iMac Pro (2017)
- Display removal tool (076-00108)
- Display removal wheels, pack of 20 (076-1417)
- ESD bags, 27x18-inch, pack of 5 (923-01193), for a 27-inch display
- ESD bags, 21x16-inch, pack of 5 (923-01194), for a 21.5-inch display
- Isopropyl alcohol (IPA) wipes, 95% or higher isopropyl
- LCD service support stand (923-0416), to support the LCD panel or when working on a VESA mount-adapted system



- Painter's tape (tape that does not leave a residue, 1 to 2 inches wide, but preferably 2-inch, if available)
- Polishing cloths, anti-static, optical-grade microterry, pack of 5 (922-8263)
- Power supply protective covers (923-0189), to use when performing live adjustments with the display panel removed
- Sticky silicone roller (6-inch) (922-8261), to adhere VHB strips to the display panel
- Sticky sheet pads (922-8262), to clean silicone roller or pick up shards of broken glass

Wireless Card Tools

- Thermal pad kit (076-1445)
Note: Whenever removing or replacing the wireless card, check for any original thermal material. If it is present, then remove the original thermal material, clean the area with an IPA wipe, and install one thermal pad to the wireless card.
- Antenna tool (optional)
 - 923-01322



- Wireless card support tools
 - 923-02218 for iMac Pro (2017)



- 923-01806 for iMac (21.5-inch, 2017) and iMac (Retina 4K, 21.5-inch, 2017)



- 923-01807 for iMac (Retina 5K, 27-inch, 2017)



- 923-00774 for iMac (21.5-inch, Late 2015) and iMac (Retina 4K, 21.5-inch, Late 2015)



- 923-00775 for iMac (Retina 5K, 27-inch, Late 2015)



Power Supply Cover Instructions



WARNING: HIGH VOLTAGE: The power supply remains powered up whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is powered off.
- Unplug computer and allow sufficient time for the power supply and logic board to self-discharge before removing display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Discharge wait time:

iMac models Late 2011 and earlier, LED Cinema Display, and Thunderbolt Display:

- Wait one hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads.

iMac models Late 2012 and later:

- Wait two minutes after unplugging the computer from the electrical outlet before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

Electrical Safety Precautions:

Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other non-metal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

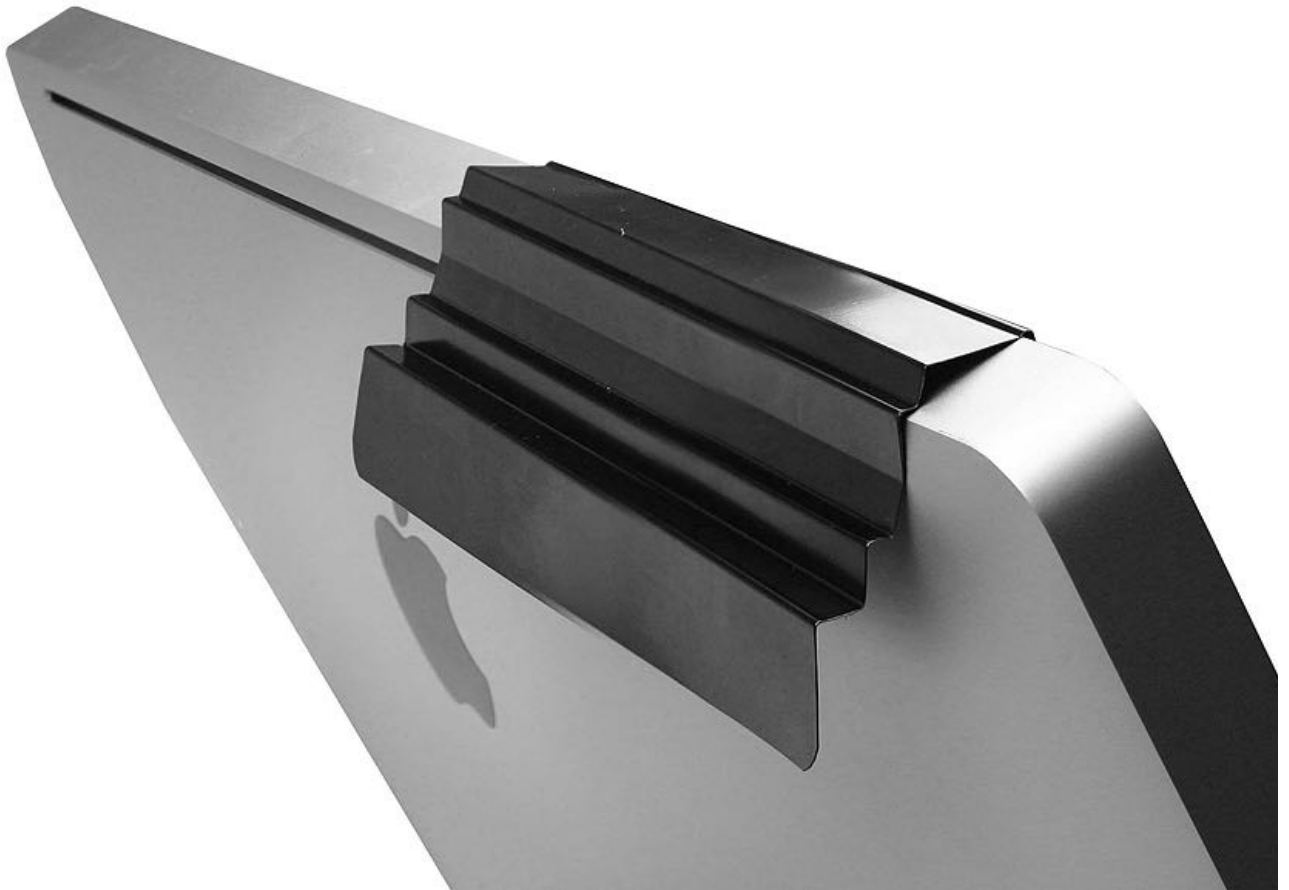
Tools Required

- A ruler
 - Kapton tape or painter's tape
 - Power supply protective cover, 923-0189, pkg. of 2
1. Before using the power supply cover for the first time, position the cover with the part number face-down, then fold the cover once to create a 90-degree bend. The fold location is marked by a linear indentation (see dotted line in image) in the cover. Use a ruler as a guide to make the fold.

Note: The iMac (Late 2012 and later) models require two protective covers when performing live adjustments; one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in step 5.

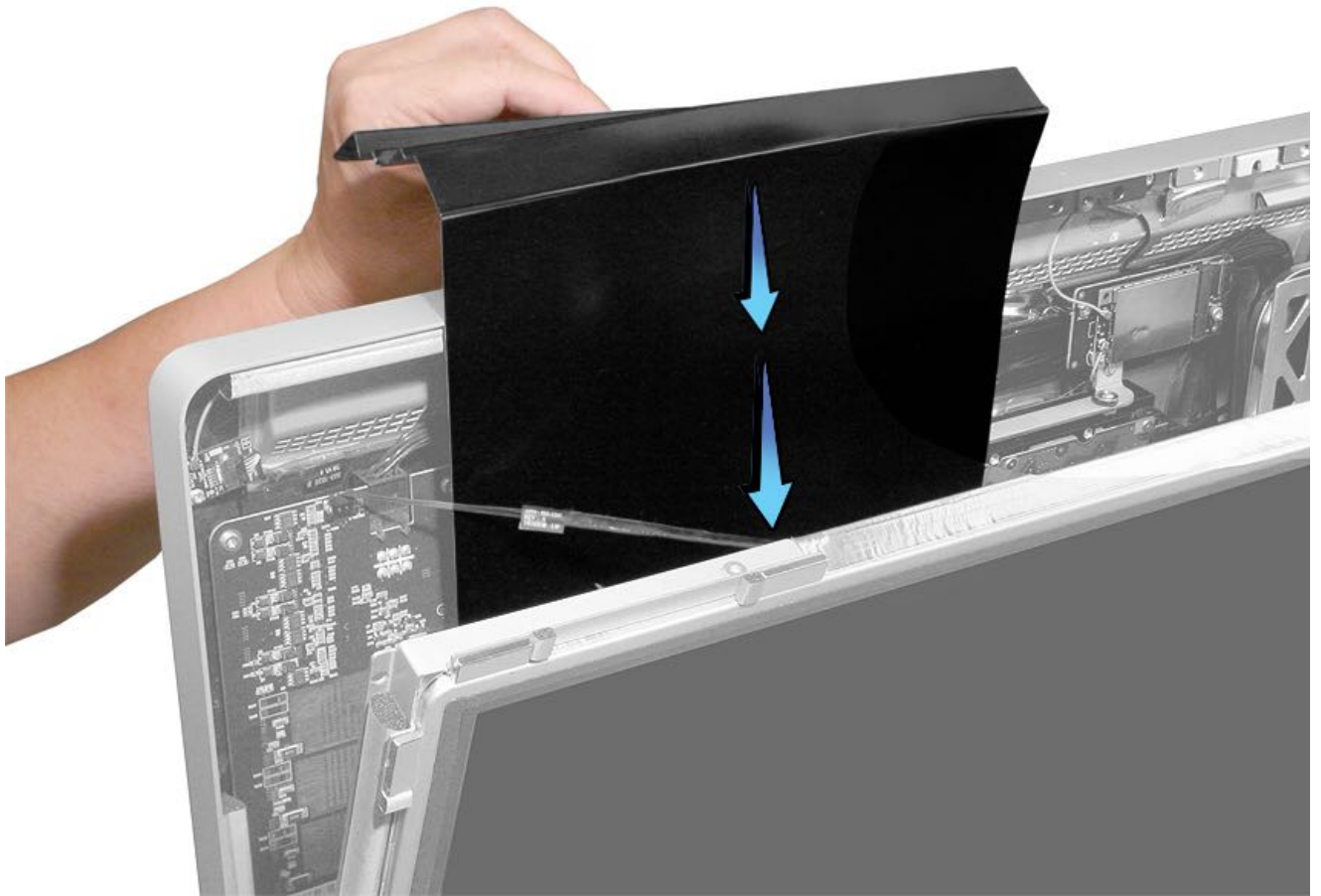


2. The pre-formed bends allow the cover to fit the rear housing on a variety of iMacs and displays (as shown).

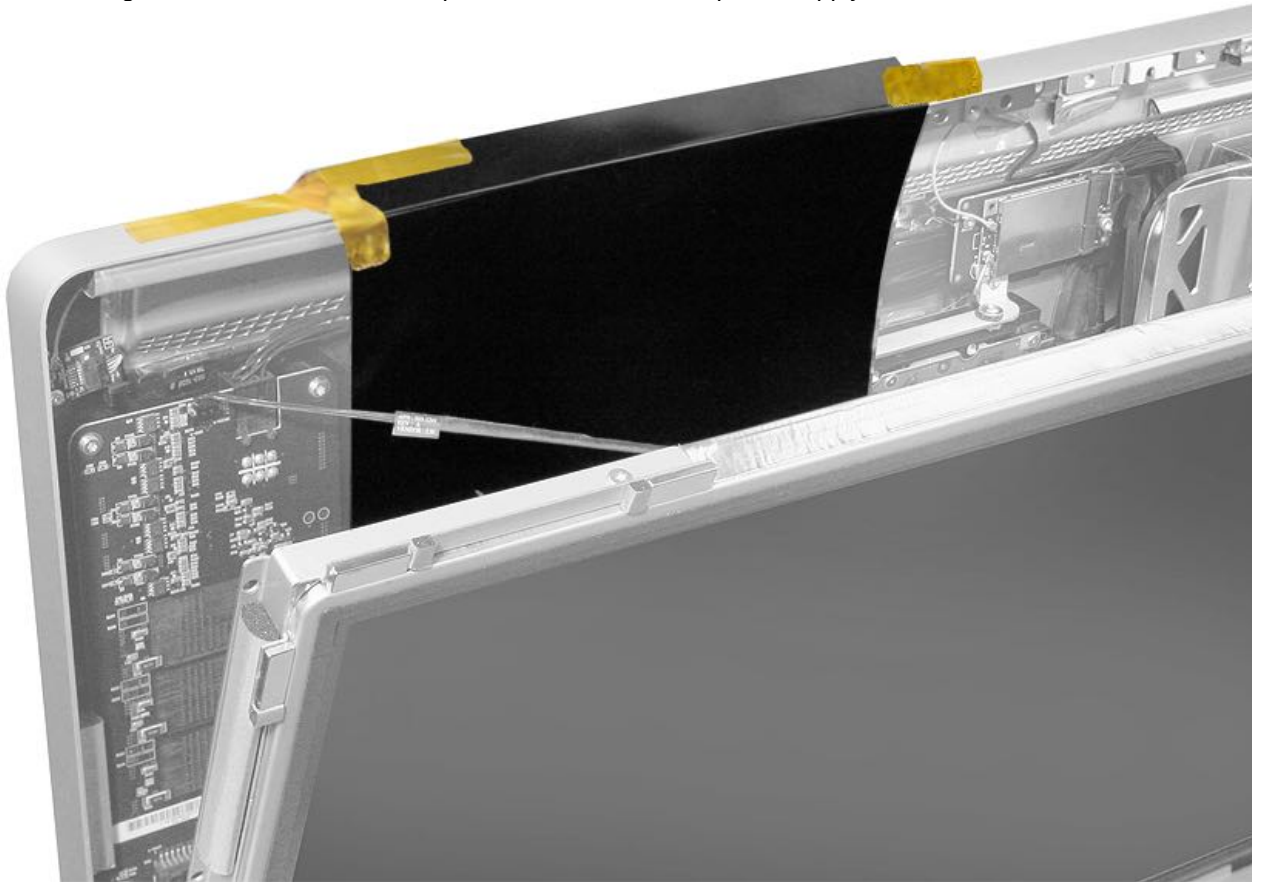


3. On older iMac models, before removing the LCD, tilt the panel open three inches and carefully slide the power supply cover into place. Hang the cover over the rear housing, covering the power supply.

Note: The iMac (Late 2012 and later) models require two protective covers when performing live adjustments; one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in step 5.



4. Secure the power supply cover with Kapton or painter's tape along the top edge of the rear housing to prevent the shield from sliding. **Note:** Refer to the model-specific Service Guide for power supply cover instructions.

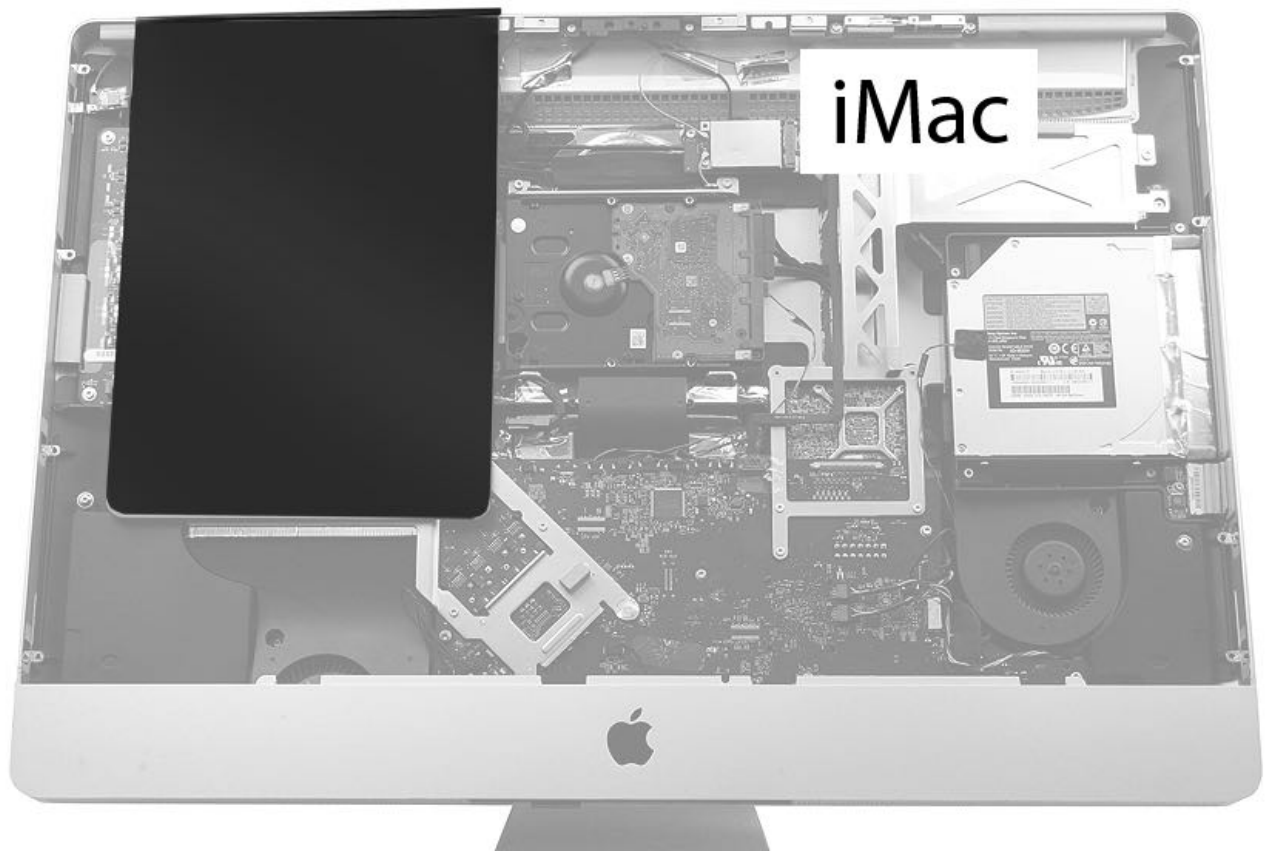


WARNING: Due to the immediate proximity of the power supply in some iMac models, do not use fingertips to

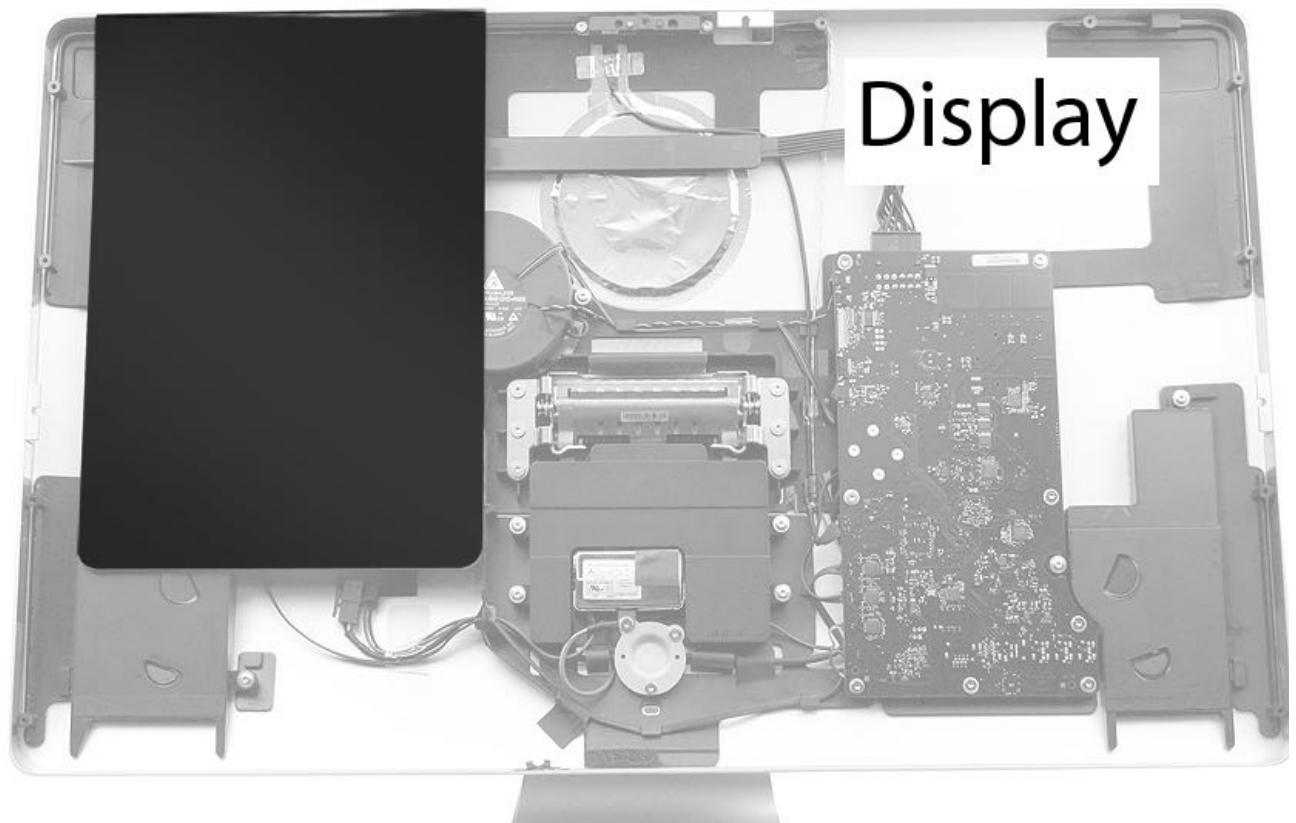
disconnect the LCD backlight controller cable. Use a black stick as directed in model-specific Apple Service Guide instructions to keep your fingertips away from the electrical hazard.

5. Make sure the energized modules are completely covered. On older models, the power supply should be covered as completely as possible before reaching into the system to disconnect display cables, remove modules, or perform live testing. On iMac models (Late 2012 and later), cover both the power supply and logic board. Refer to the last two images in this step for their cover placement.

iMac models (Late 2011 and earlier) protective power supply cover placement



LED Cinema Display and Thunderbolt Display protective power supply cover placement



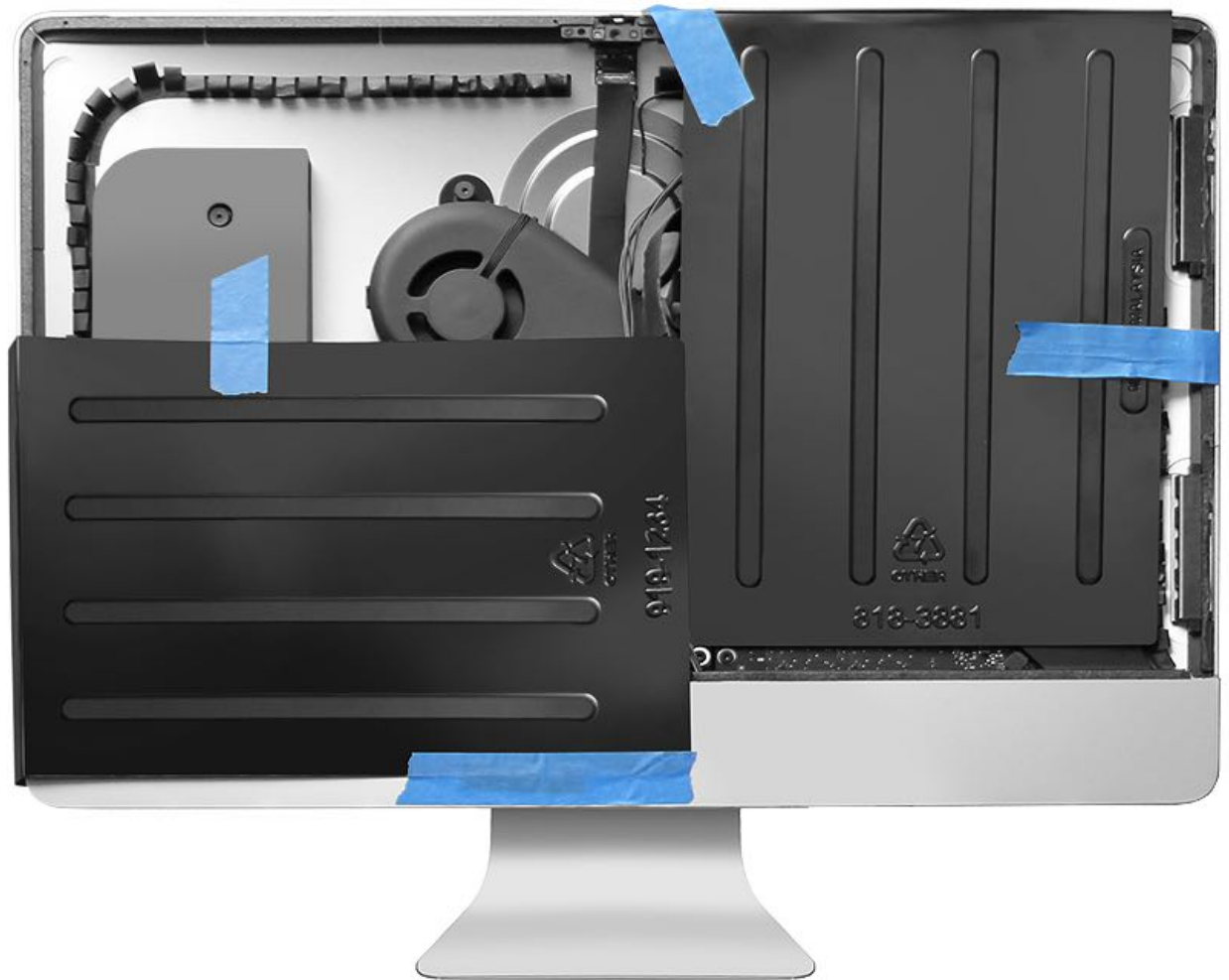
iMac (27-inch, Late 2012 and later) protective power supply cover placement

Warning: On these models, place a cover over both the power supply and logic board when doing live adjustments. Avoid touching the logic board or power supply while the computer is plugged in.



iMac (21.5-inch, Late 2012 and later) protective power supply cover placement

Warning: On these models, place a cover over both the power supply and logic board when doing live adjustments. Avoid touching the logic board or power supply while the computer is plugged in.



6. The power supply protective cover may be reused. However, before reusing, visually inspect shield for:
 - Holes, tears, punctures, or cuts.
 - Textural defects such as swelling, softening, hardening, or stickiness.
 - Other defects that degrade insulating quality.
7. If any wear or other defects are found, discard the shield, and use a new cover (part number 923-0189).

Safety

Safety for iMac (27-inch, Late 2012 – 2017)



Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Refer to article [TP833: iMac and Displays: Power Supply Cover Instructions](#) for additional information on installing the protective covers. The power supply cover provides protection against unintended contact with the energized power supply, which may result in injury from electric shock. ALWAYS use the protective power supply cover during service when the glass panel and LCD have been removed from the iMac, LED Cinema Display, and Thunderbolt Display.

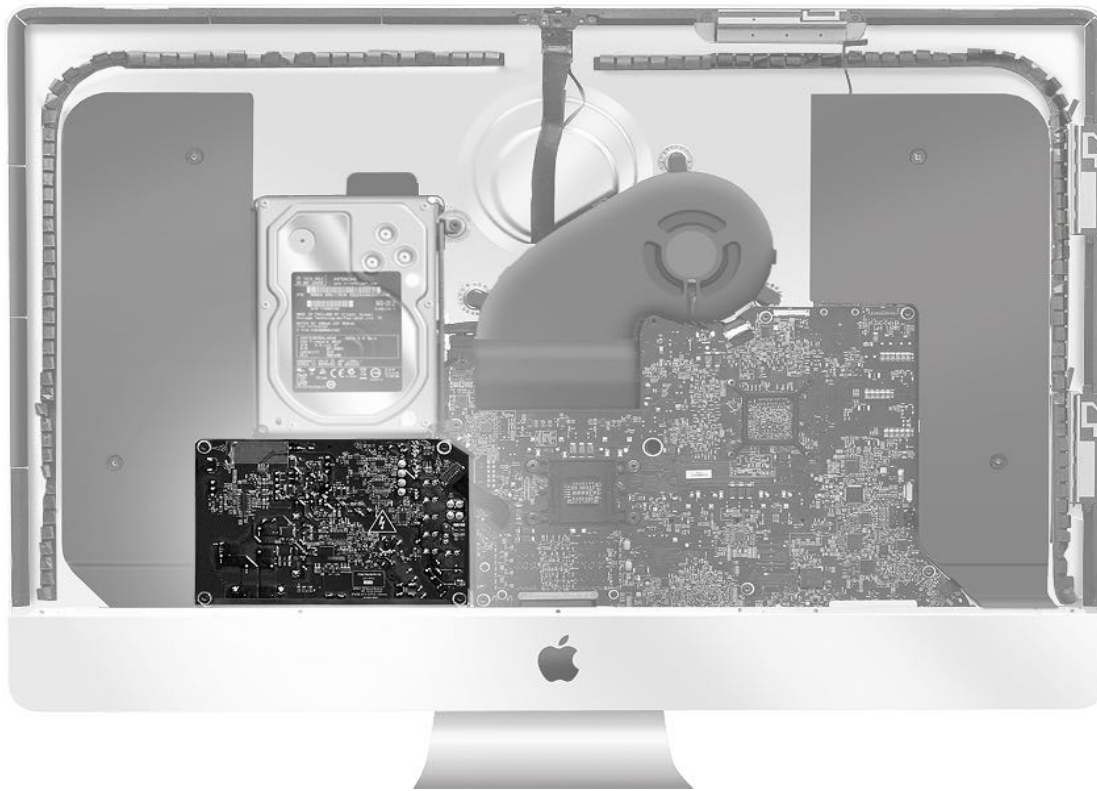
Warning: iMac (Late 2012 – 2017) models require two protective covers (923-0189) when performing live adjustments; one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in the last image below.

Electrical Safety Precautions

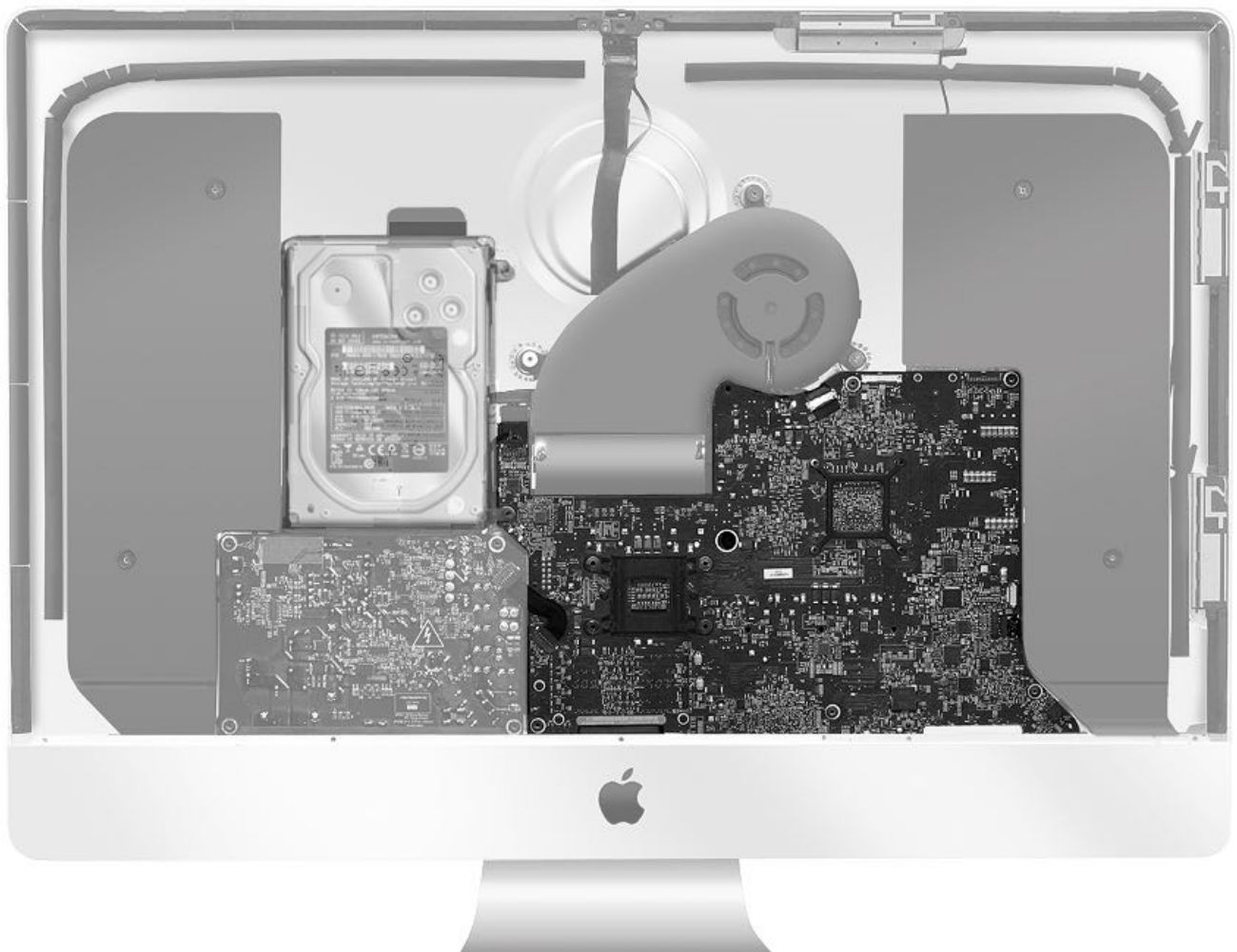
Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing an ESD grounding system increases your risk of electric shock in this situation.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other non-metal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

iMac (27-inch, Late 2012 – 2017): Power supply location



iMac (27-inch, Late 2012 – 2017): Logic board location



iMac (27-inch, Late 2012 – 2017): Protective power supply cover placement

Warning: Use the protective power supply covers when the computer is plugged in or when performing live adjustments. On these models, place a cover over both the power supply and the logic board when doing live adjustments. Secure the covers to the rear housing with tape, as shown below. Avoid touching the logic board or power supply while the computer is plugged

in and the display panel is removed.

Refer to articles:

- [TP833: Power Supply Cover Instructions](#)
- [TP981: Testing the Panel Using the Display Extension Cable Kit](#)



Cleaning and Handling a Broken Display Panel

Cleaning and Handling a Broken Display Panel for iMac (Late 2012–2017) and iMac Pro (2017)

Tools for Cleaning the Display Panel

- Safety glasses
- Service wedge (iMac) (included with the display panel starter kit, 076-1444)
- Clean, damp cloth (to clean display panel glass)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)

Cleaning the Display Panel

1. Clean the front of the display with a clean, damp, lint-free cloth. **Note:** Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.
2. Polish the display panel with an antistatic, microterry, optical-grade polishing cloth (922-8263, package of five).



Glass Safety Precautions

All models have a glass display panel that attaches to the front of the computer, which must be removed to access internal components.

Handling a Broken Display Panel

- The display panel's glass is not tempered and will break into sharp pieces if mishandled. Removing the display panel requires special tools.
- Safety glasses are recommended when removing the display panel.

Tools

- Display panel starter kit (Refer to [TP818: Required Tools](#) for part numbers.)
- Material handling gloves (such as leather or cut-resistant gloves)
- Packing tape or equivalent
- Safety glasses

- Large ESD bags (922-8258) – 24x20-inch bags that accommodate a 21.5-inch display, package of five
- Large ESD bags (922-9468) – 24x30-inch bags that accommodate a 27-inch display, package of five
- Large box for disposal

Safety Information



If the display panel breaks and a glass shard enters the eye:

- Seek medical attention immediately!
- Do not rub your eye if you feel you have something in your eye.
- Do not use an eye wash. An eye wash can push or move the shard of glass and cause more damage.
- Keep the eye closed or loosely patch the eye to keep the eye from moving.



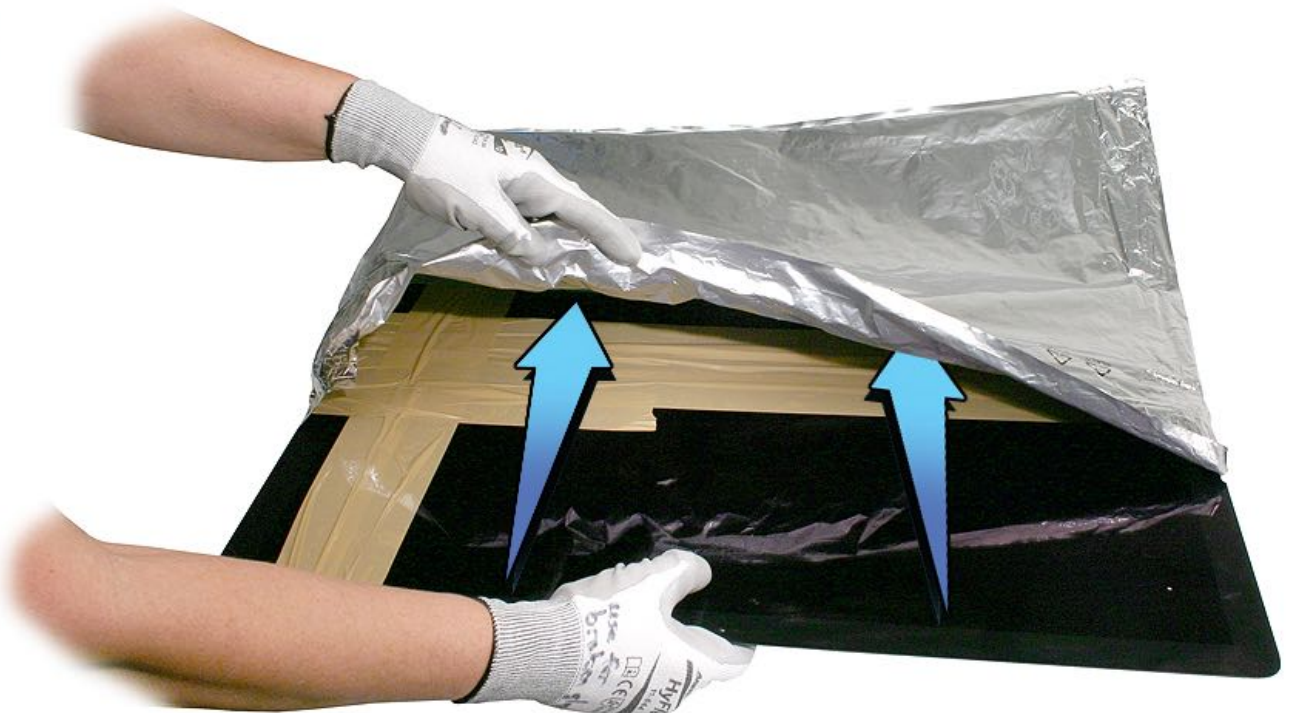
Handling a Broken Display Panel

1. Put on safety glasses and material handling gloves.
2. If the display panel is broken and is still attached to the rear housing, then secure the broken glass with packing tape and carefully follow the Display Panel Removal procedure.
 - [RP1021: iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\): Display Panel Removal](#)
 - [RP1230: iMac \(21.5-inch, Late 2015 and 2017\) and iMac \(Retina 4K, 21.5-inch, Late 2015 and 2017\): Display Panel Removal](#)
 - [RP950: iMac \(27-inch\) Display Panel Removal](#)
 - [RP1403: iMac Pro \(2017\) Display Panel Removal](#)
3. Lay the display panel on a smooth, clean work surface.
4. Apply tape, thoroughly covering the broken display panel.



4.

5. Place the taped display panel in the ESD bag that the replacement panel came in (or an equivalent large bag).



6. Place the display panel inside a large box, label the box "Broken Glass," and return the display back to Apple using the normal return process.



Take Apart Procedure Notes

Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



RAM Access Door

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

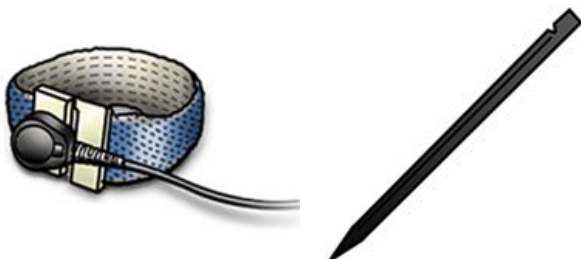
Before you begin:

- Shut down the computer.
- Unplug power and disconnect peripherals.
- Put on an ESD wrist strap.



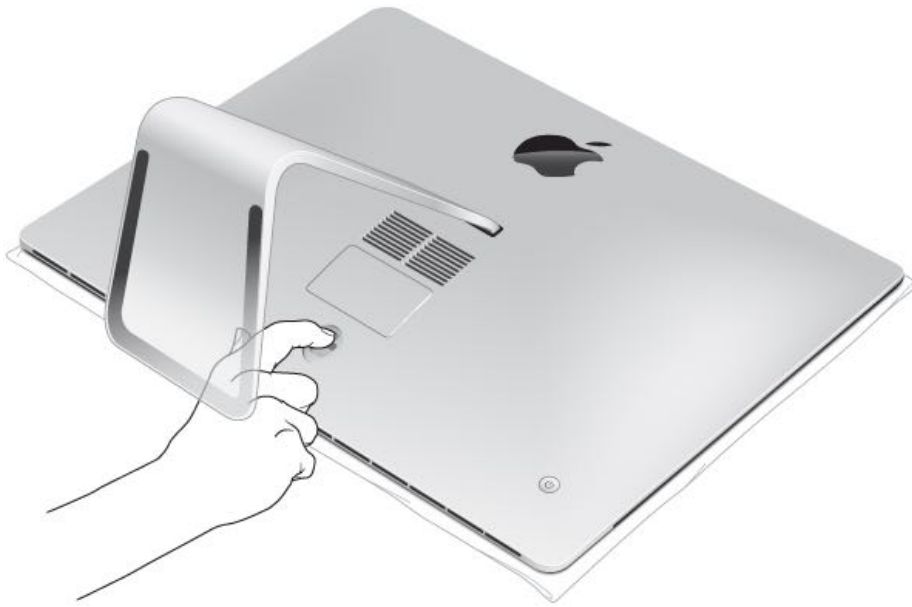
Tools

- ESD wrist strap and mat
- Black stick or flat-blade screwdriver
- Clean towel or soft cloth

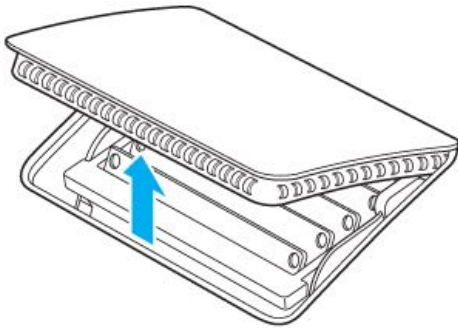


Steps For Removal

1. Place a soft and clean towel or cloth on desk or other flat surface to prevent scratching the display.
2. Lay the computer face down on the towel or cloth.
3. For this step, use your finger, a black stick, or a small flat-blade screwdriver. Open the SDRAM compartment door by pressing the small black button located just above the AC power port. The SDRAM compartment door will open as the button is pushed in.



4. Remove the compartment door and set it aside.



Steps For Reassembly

Reinstall the RAM compartment door. There is no need to press the compartment door release button when replacing the compartment door.

Memory

First Steps

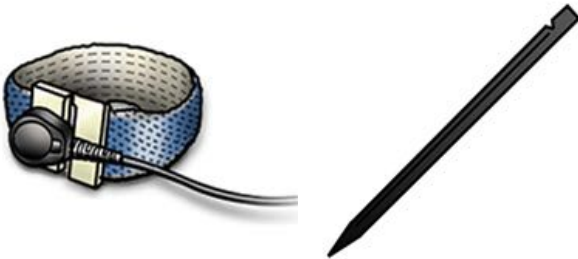
Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Memory Location



Tools

- ESD wrist strap and mat
- Black stick
- Soft cloth or clean towel

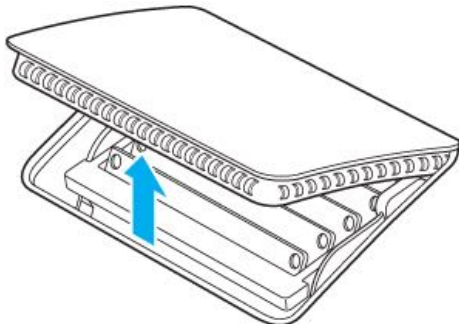


Steps For Removal

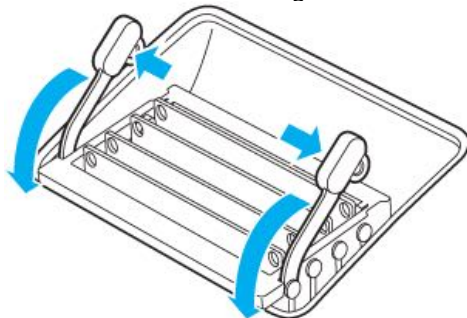
1. Turn off the computer by choosing Shut Down from the Apple () menu.
2. Disconnect the power cord and all other cables from the computer.
3. Place a soft, clean towel or cloth on the desk or other flat surface to prevent scratching the display.
4. Hold the sides of the computer and carefully lay the computer face down on the towel or cloth.
5. For this step, use your finger or a black stick:
 - Open the SDRAM compartment door by pressing the the small button located just above the AC power port.



- The SDRAM compartment door will open as the button is pushed in. Remove the compartment door and set it aside.
Note: There is a diagram on the underside of the compartment door which shows the memory cage levers and the orientation of the DIMM.



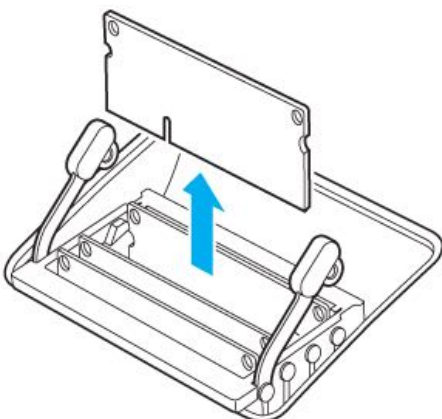
- Locate two levers on the right and left sides of the memory cage. Push the levers outward to release the memory cage.



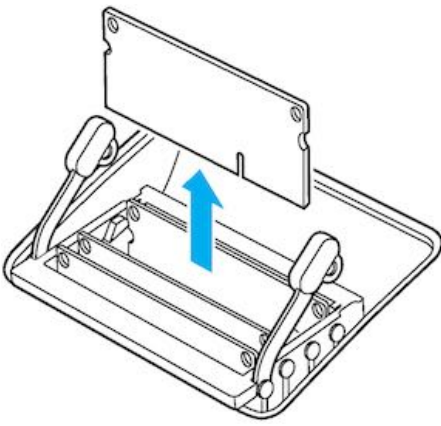
6. After the memory cage is released:

- Pull the memory cage levers toward you, allowing you to access each individual DIMM slot.
- Remove a DIMM module by pulling the module straight up and out, handling it only by the left and right edges.

iMac (27-inch, Late 2012)



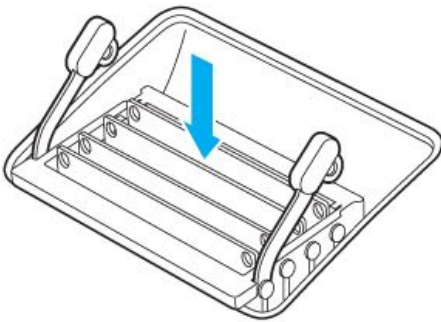
iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



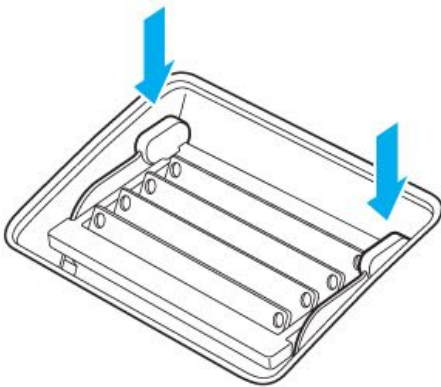
Steps For Reassembly

1. Replace or install a DIMM by setting it down into the slot and pressing until you feel the DIMM click into the slot.

Important: Be sure the DIMM is fully seated and has clicked into place. If the DIMM is not fully seated, it may not be recognized by the computer and the computer may not power on.



2. After you have installed the modules, push the memory cage levers back into the housing until they click back into place.



3. Place the computer in an upright position.
 4. Replace the RAM access door.
 5. Start up the computer.
 6. When the computer turns on, go to “About this Mac” to confirm the correct configuration of memory is recognized.
- Important:** If the computer does not start up, disconnect the power cord and start again at reassembly Step 1 to confirm the DIMM is seated properly.

Display Panel Removal

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV116: Display Panel Removal and Replacement Video](#).

Before you begin:

- Shut down the computer.
- Unplug power and disconnect peripherals.
- Put on an ESD wrist strap.



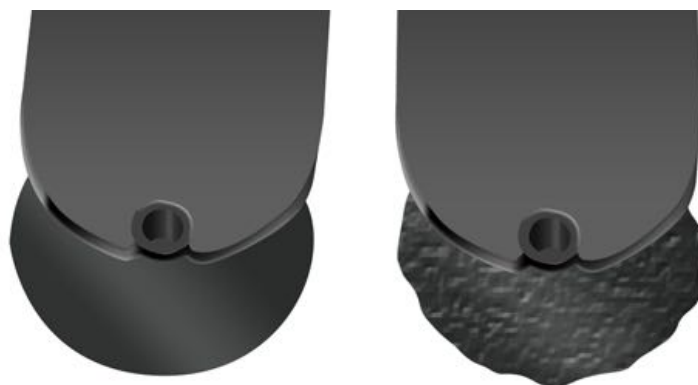
Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- ESD-safe bag
- Black stick
- Display removal tool
- Replacement wheels for display removal tool (several)
- Safety glasses



The display panel must be removed for all repairs. The display is affixed to the computer housing with very high bond (VHB) adhesive strips. These VHB strips must be cut with the display removal tool in order to remove the LCD panel. Each VHB strip consists of two adhesive layers and a foam layer (VHB/foam/VHB). When you remove the display, you are cutting primarily through the foam layer.

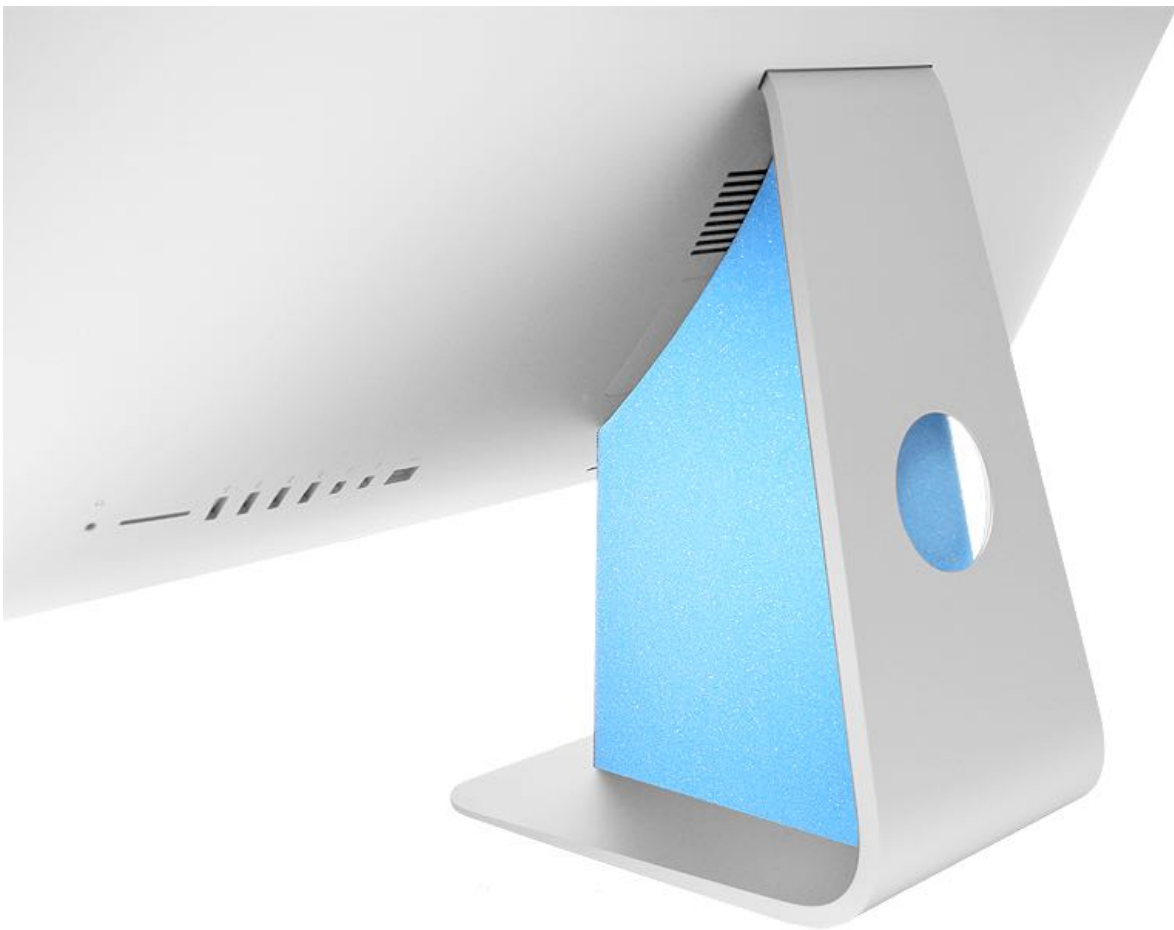
The main tool is the display removal tool. The tool uses replaceable wheels (076-1417) that cut through the foam layer in the VHB strip. With careful use, these wheels can be reused five to ten times. When the wheel becomes nicked from contact with the chin, further use becomes difficult. Because of this, the tool should only be used along the top and sides of the display, and not along the chin. To remove the VHB strips along the chin, lower the display and pull the outer vertical tab on the strips.



Steps For Removal

Important: In the unlikely event that the display glass cracks or breaks, refer to [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Use the service wedge to hold the display steady. When positioned correctly, the service wedge covers the power receptacle. Rotate the computer so the display panel is facing you.



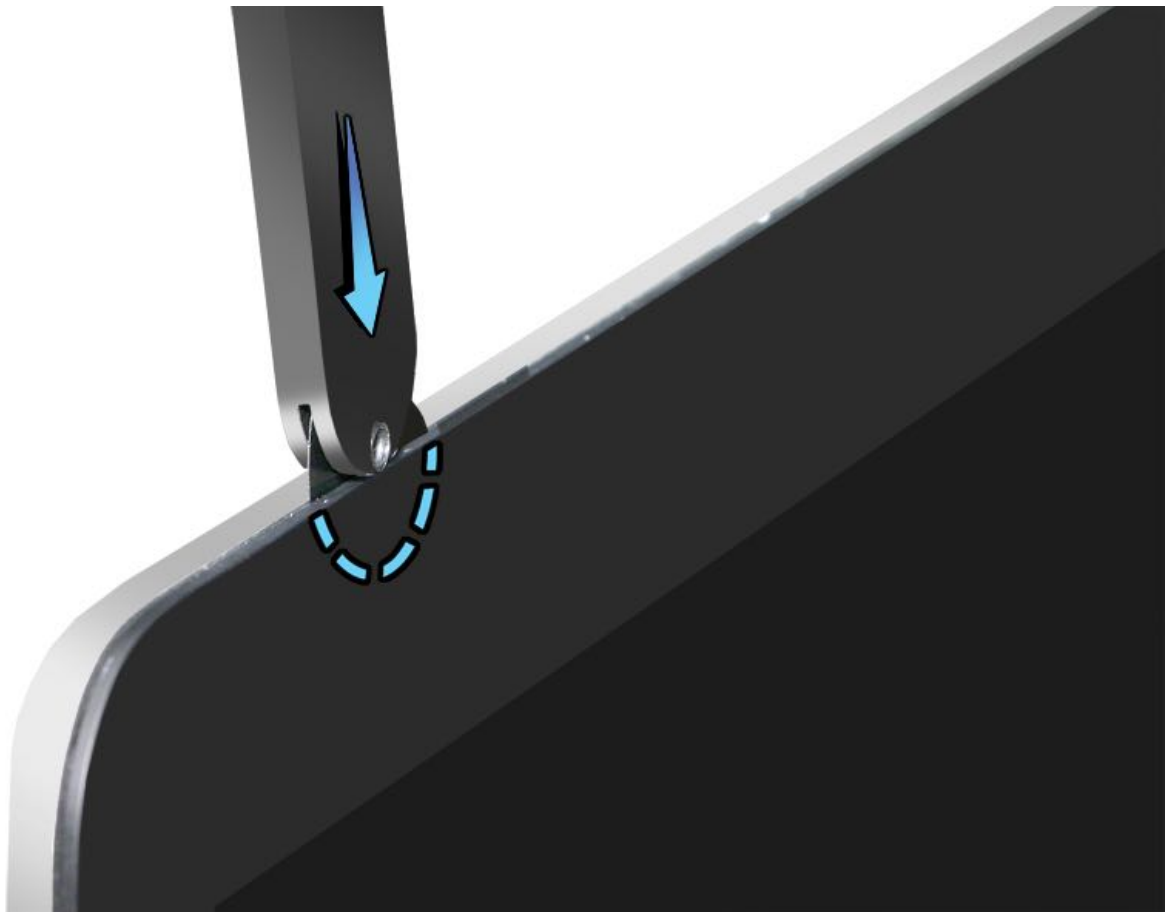
2. Place a wheel on the removal tool by inserting the wheel into the notch on the handle. Push firmly until the wheel clicks into the notch. The tool cuts the foam core, which is located between two layers of VHB adhesive that secure the display panel to the rear housing.



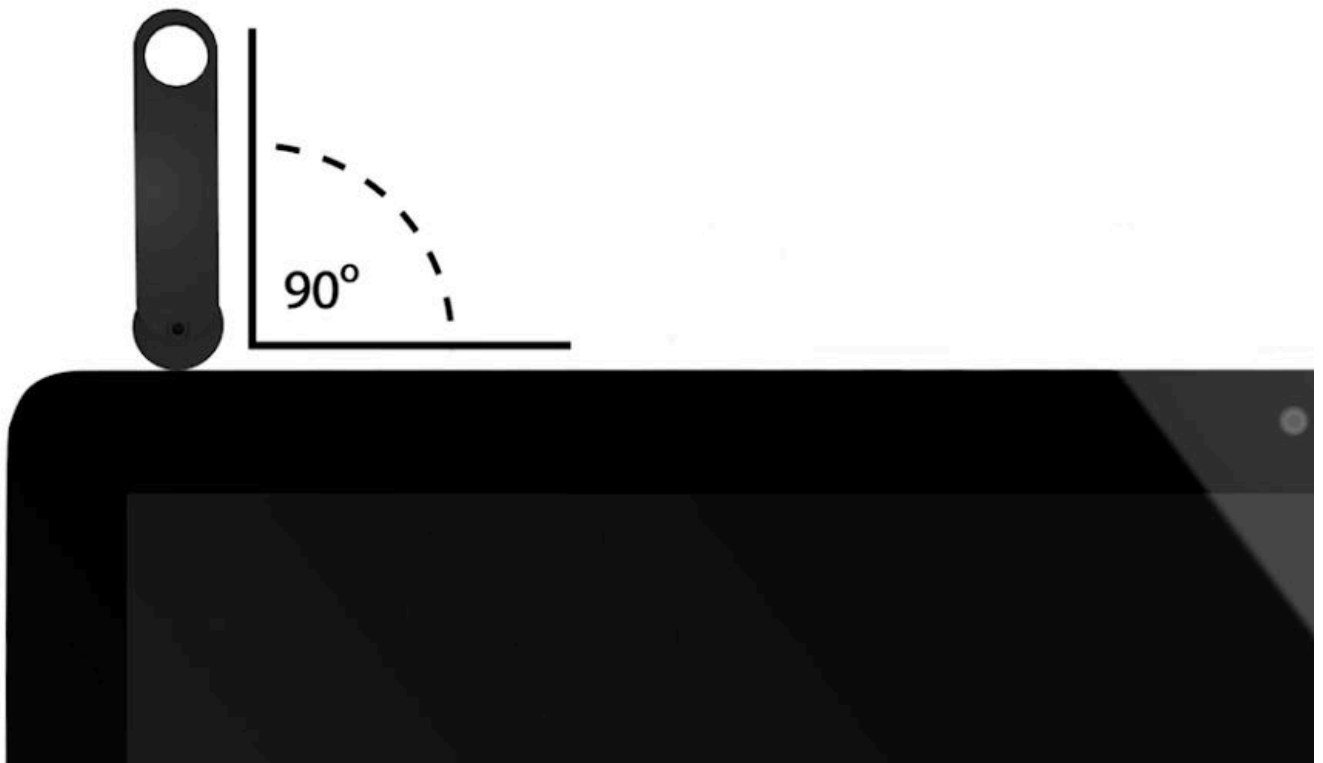
Caution: If the wheel becomes worn during use, then change the wheel. A worn wheel could permanently damage the black Mylar that is adhered to the edges on the back of the display panel glass.

3. Use only the display removal tool to cut through the foam layer of the VHB adhesive. Insert the display removal tool into the gap between the display panel and rear housing.

Note: The tool should only be used along the top and sides of the display, not along the chin.



4. Hold the display removal tool perpendicular to the edge of the computer.

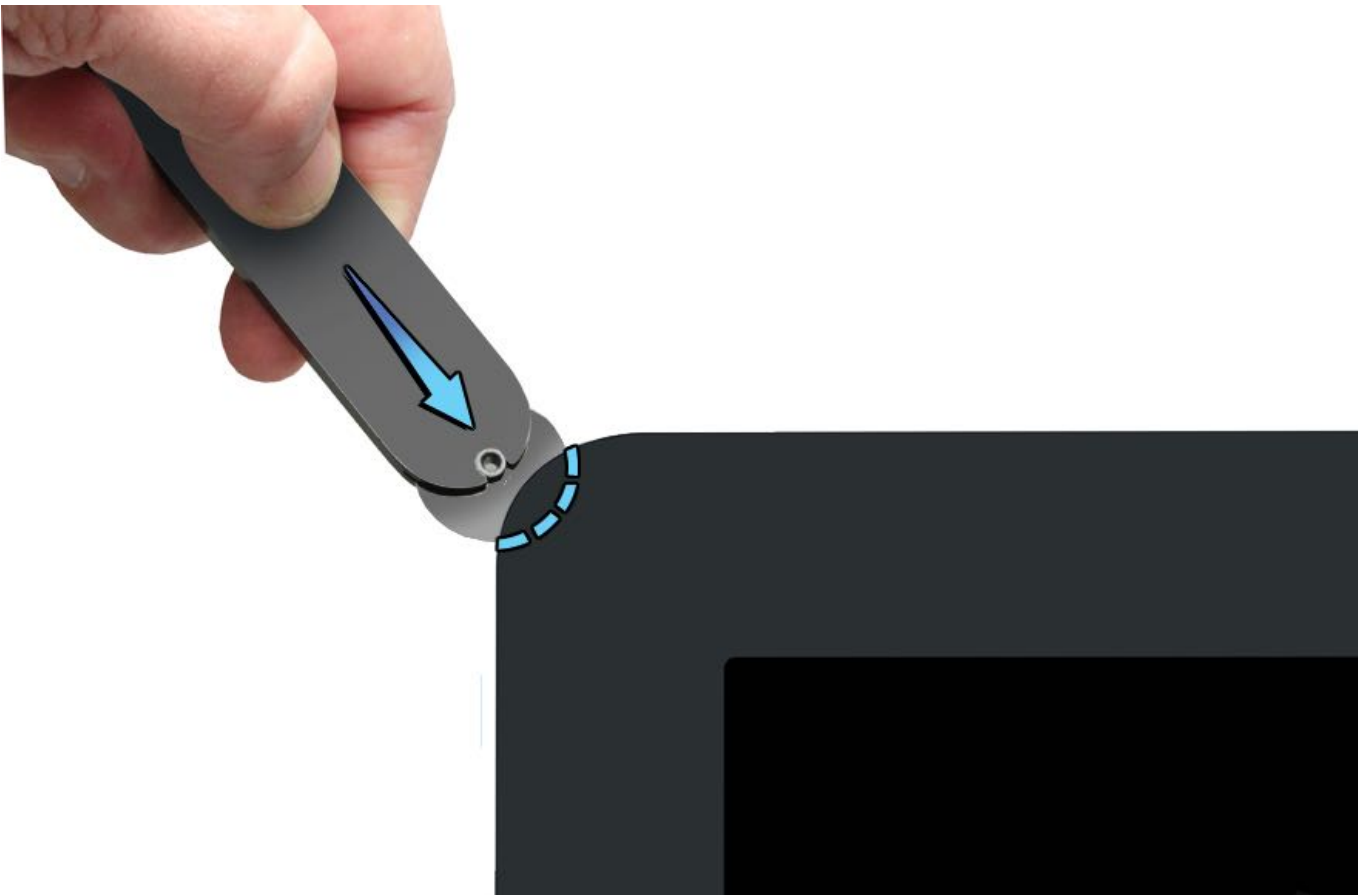


5. Roll the tool along the top and sides of the display panel. Move the tool back and forth until it moves with minimal resistance.

Note: Because there is no VHB adhesive at the top center, where the camera is located, there is no need for a continuous swipe across the top.



6. Pay special attention to the top corners, as the tool must make steady contact with the display and housing.



7. Use the flat end of a black stick to gently remove any visible VHB from the edges of the rear housing.

Caution: Forcing the black stick between the display panel and the rear housing may cause the display panel to fracture.



Caution: Pay special attention to the location of the Wi-Fi/Bluetooth antennas. **Do not pry** in these areas with the black stick.



8. Use the black stick and your fingers to carefully separate the display panel from the top of the rear housing. If there is resistance, then you need to remove more VHB material.



9. Tilt the display open slightly, just enough for your hand to reach the cables that connect the display to the logic board.

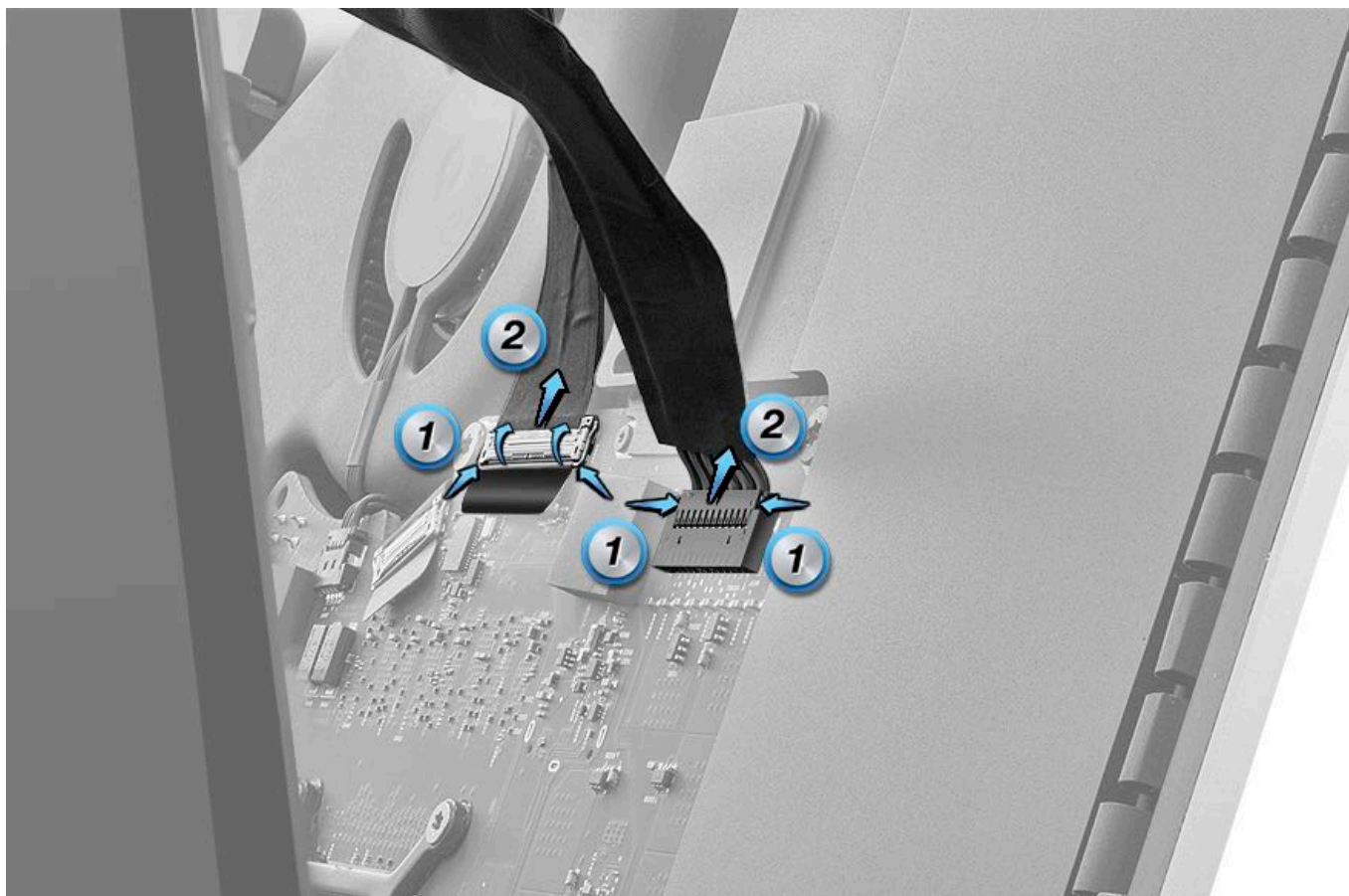
Caution: Be extremely careful not to stress the display cables and connectors (on the logic board) when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, then the logic board will need to be replaced.

Remember that the bottom edge of the display is still attached with VHB. **Do not** remove the display panel yet.

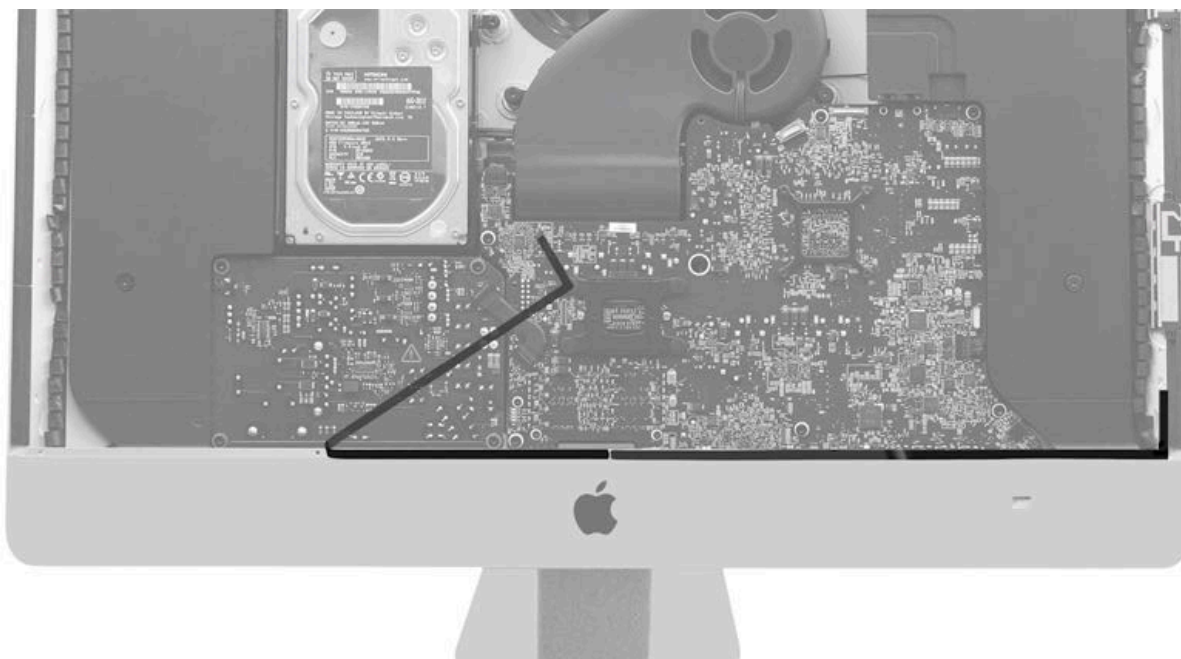


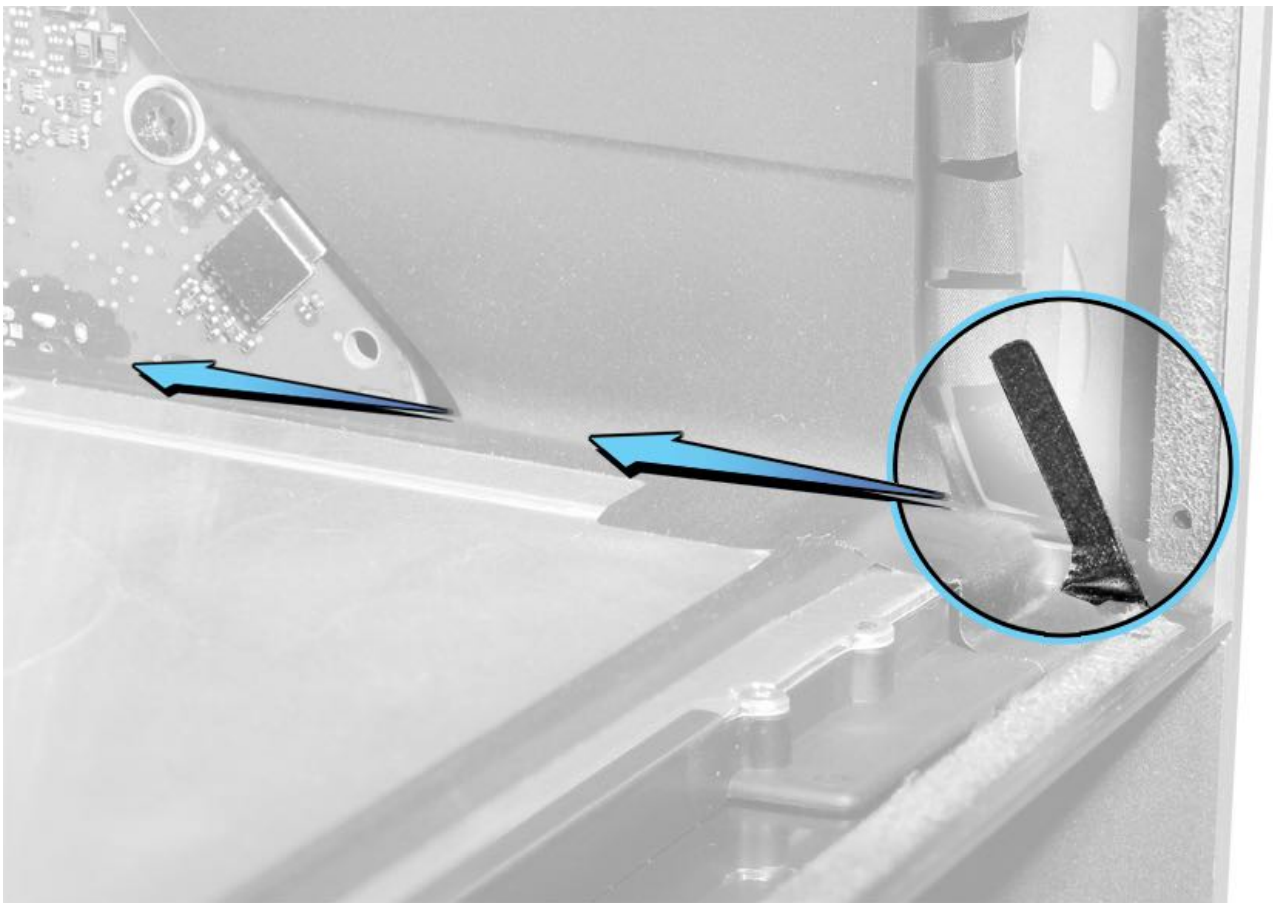
10. Carefully remove the Embedded DisplayPort (eDP) cable (on the left) from the logic board by moving the locking lever (#1) up and pulling the cable (#2) straight out of its connector. Disconnect the display backlight power cable (on the right) from the logic board by pinching the sides (#1) and pulling the power cable (#2) straight out of its connector.

Note: The display backlight power cable is part of the display panel assembly and is not a separate part.



11. Lower the display panel (not shown). Locate the two VHB strips along the chin. Pull the VHB tab on each strip toward the center.





12. Gently pull the display panel off of the rear housing and store it in an ESD-safe bag.

Caution: If the panel is sticking to the rear housing, then use a black stick to carefully break the VHB bond between the display and the iMac rear housing. Be careful not to damage the black Mylar on the display. If the black protective Mylar is pulled from the display, then the display panel may need to be replaced.



Steps For Reassembly

1. Remove the [display panel VHB strips](#).
2. Install new [display panel VHB strips](#).
3. Reinstall the [display panel](#).

Display Panel - Removing Very High Bond (VHB) Strips

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV116: Display Panel Removal and Replacement Video](#).

Remove:

- [Display panel](#)



Tools

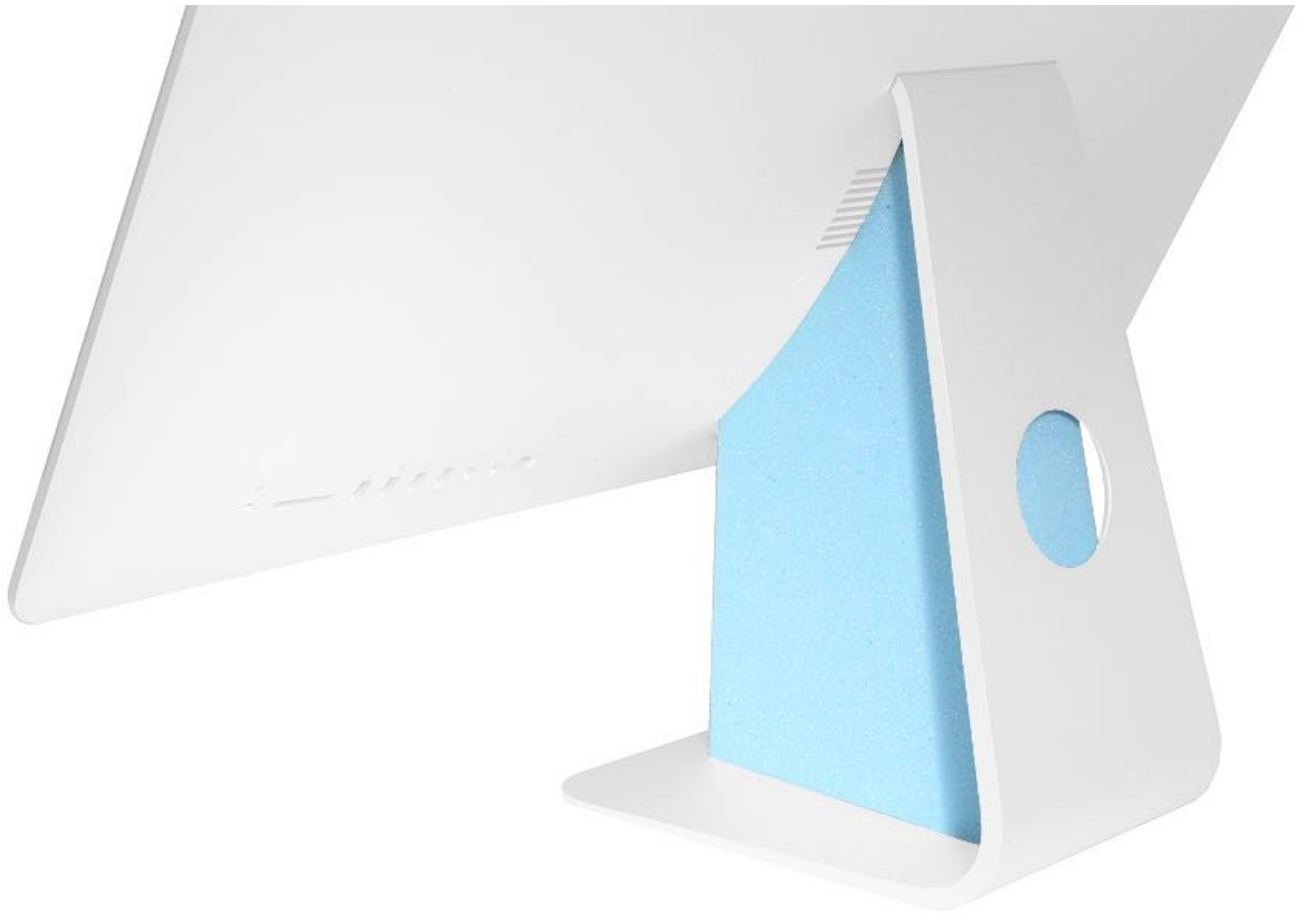
- ESD wrist strap and mat
- Black stick
- Isopropyl alcohol (IPA) wipes
- Service wedge (iMac)



Steps For Removal

Note: On the rare occasion that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

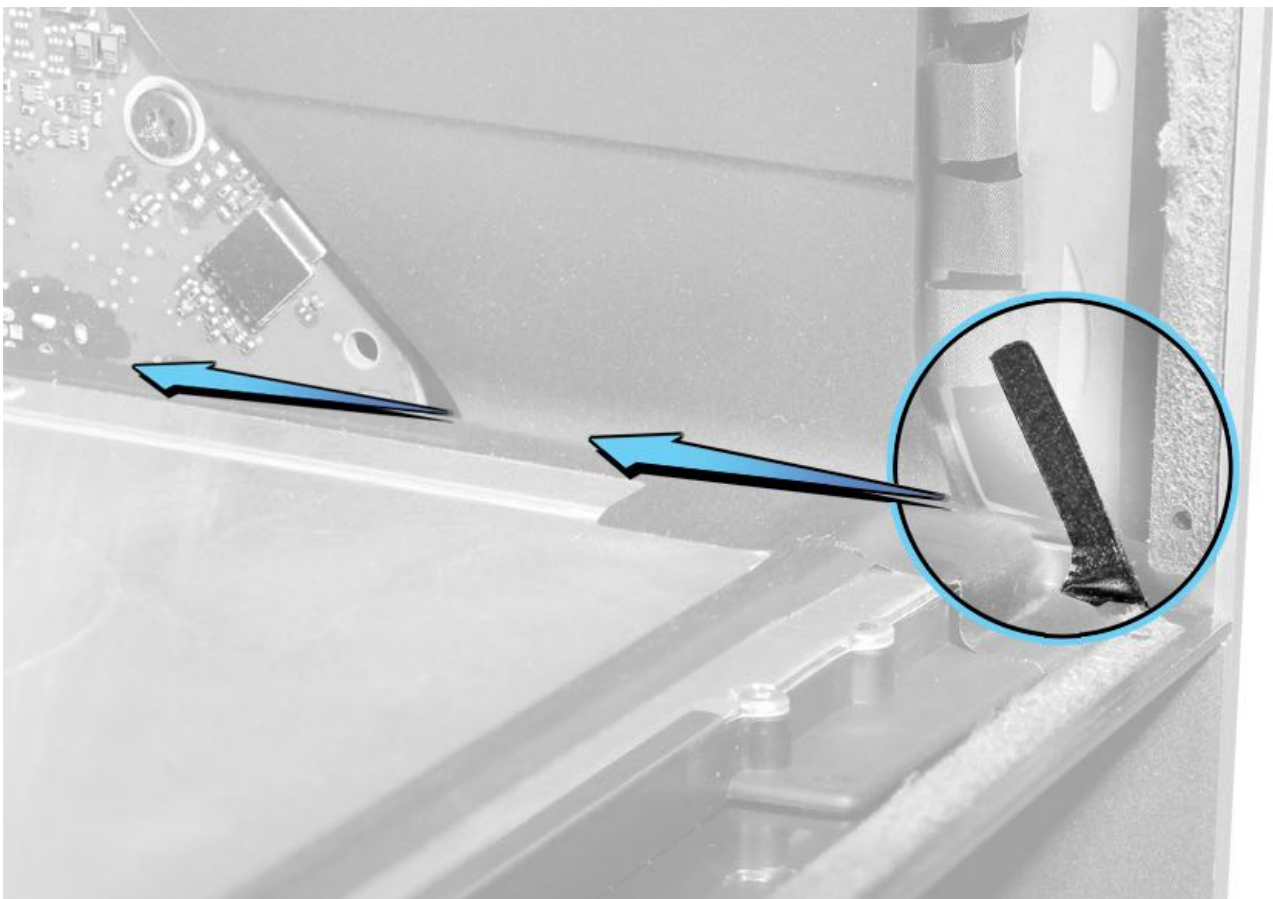
1. Insert the service wedge to hold the display steady for this procedure. When positioned correctly, the service wedge covers the power receptacle.

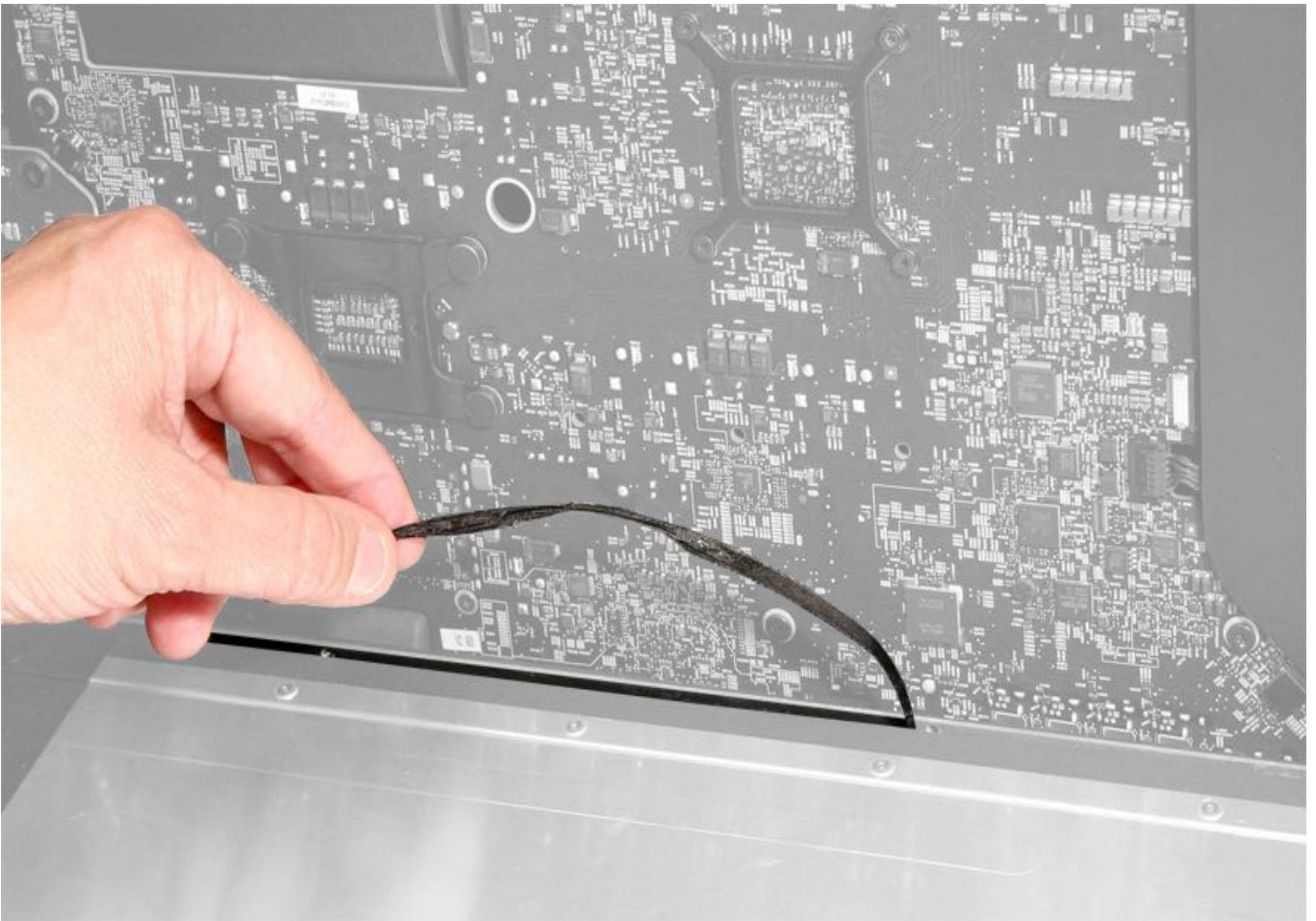


2. Use your fingers and the flat end of a black stick to remove any residual very high bond (VHB) adhesive from the rear housing.



3. Along the bottom, locate the VHB pull tabs at the lower left and lower right corner of the display. While supporting the display, carefully pull the VHB tabs towards the center to break the VHB bond.



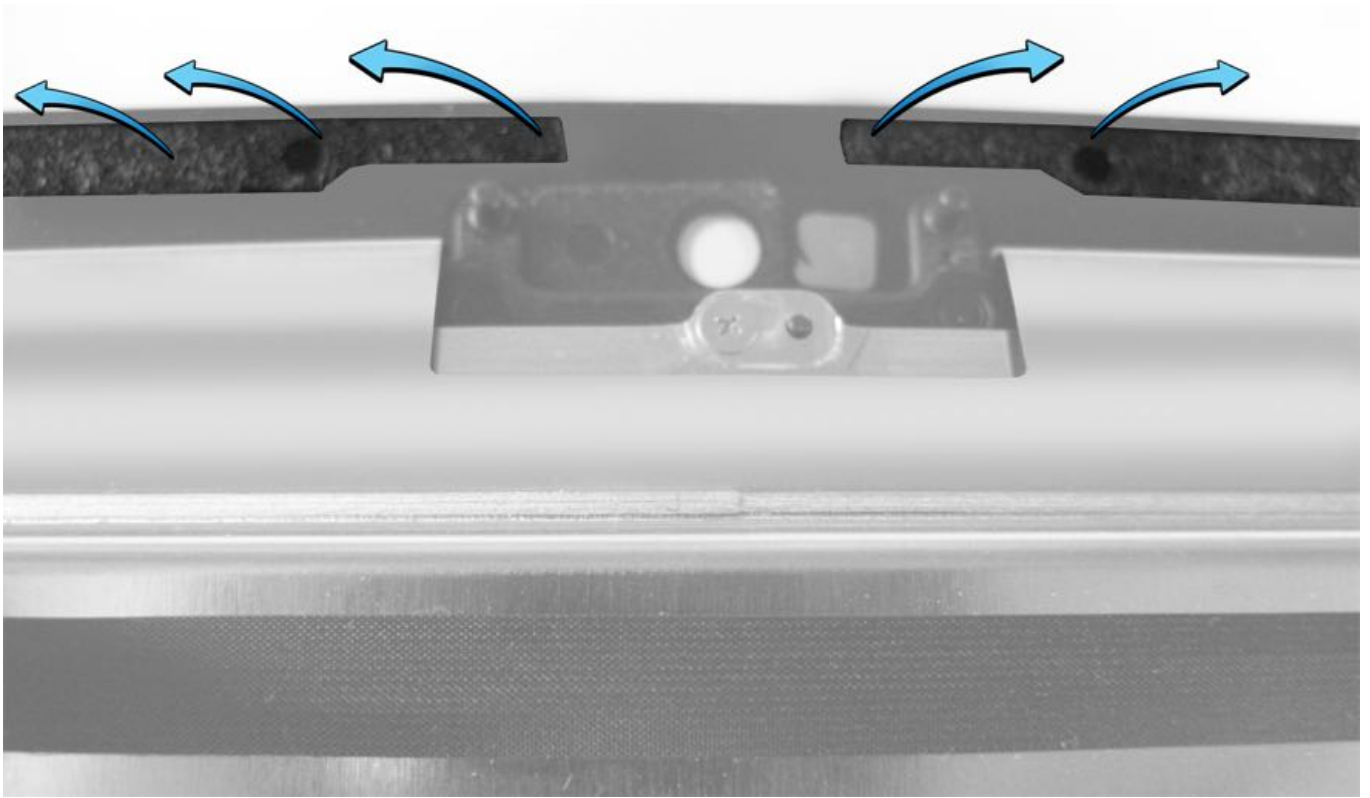


4. **Note:** Be careful when removing VHB from the display panel. To prevent damage to the black Mylar protective film that is located on the display panel glass, ensure that you are peeling up the VHB and **not** the Mylar film. An easy way to ensure that you do not peel up the Mylar film on the display is to start peeling the VHB from the center points, not from the corners of the display.

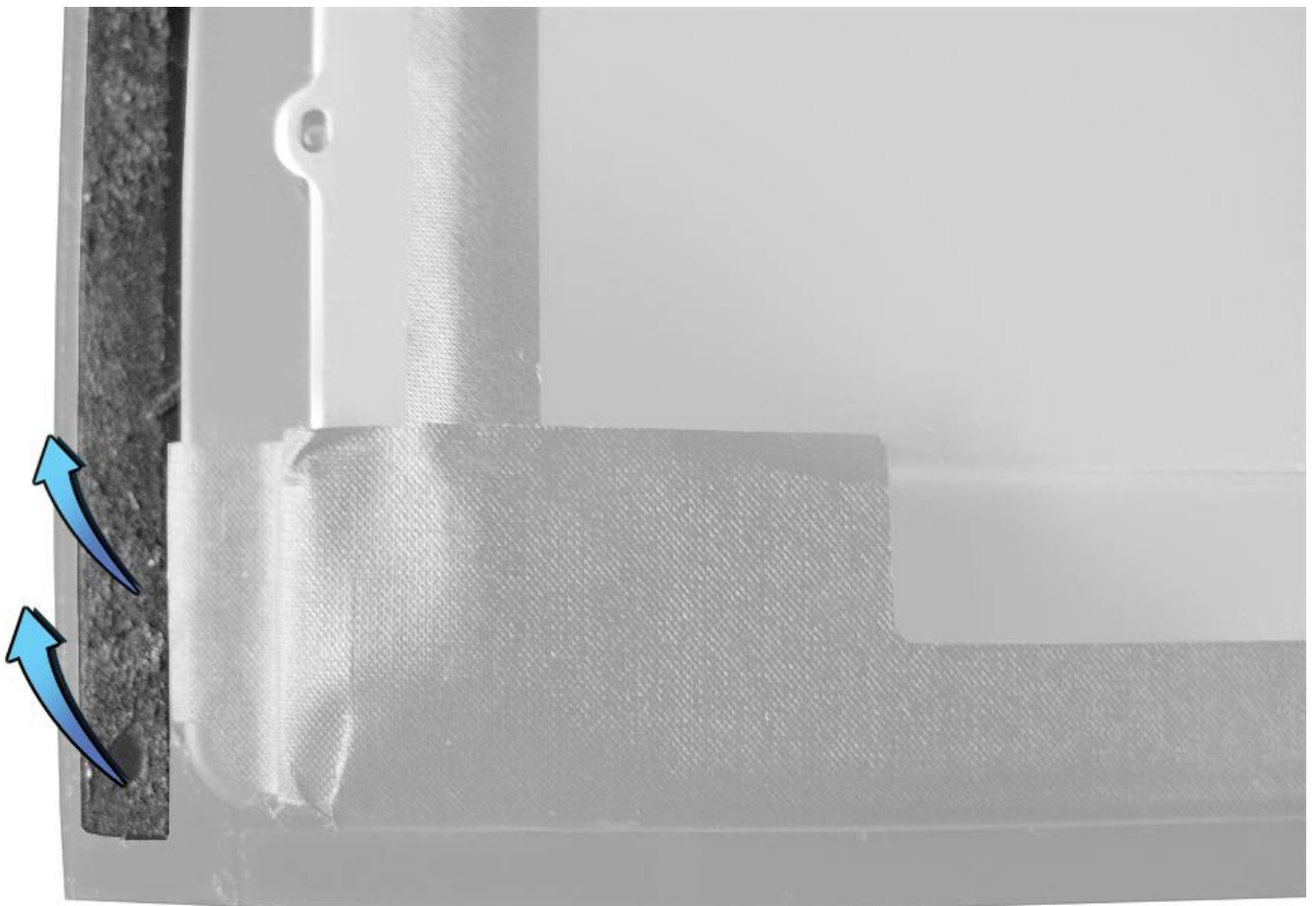
Peeling VHB from the display panel:



Top of display shown. Peel VHB to the left and right, above the camera module location.

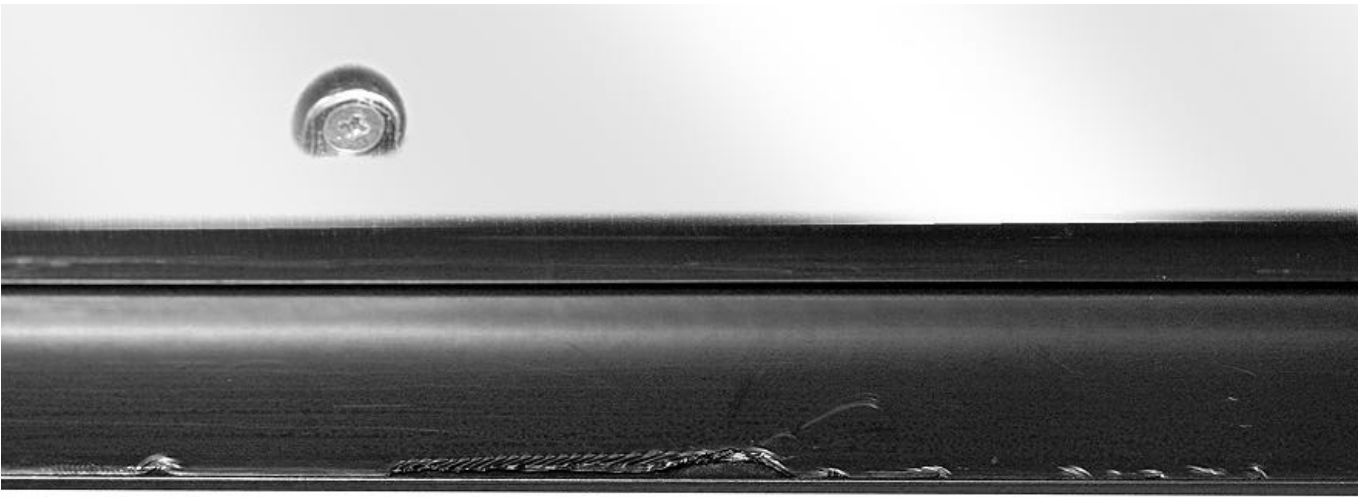


At the bottom corners of the display, peel the VHB upward.



Note: If the black protective Mylar film is peeled or wrinkled on the display (as shown below), then press the film back onto the panel with your finger. The Mylar should be smooth and undamaged. Use caution when working around the black Mylar protective film. If the Mylar is pulled from the display, then the display panel may need to be replaced.

Display panel Mylar damage:



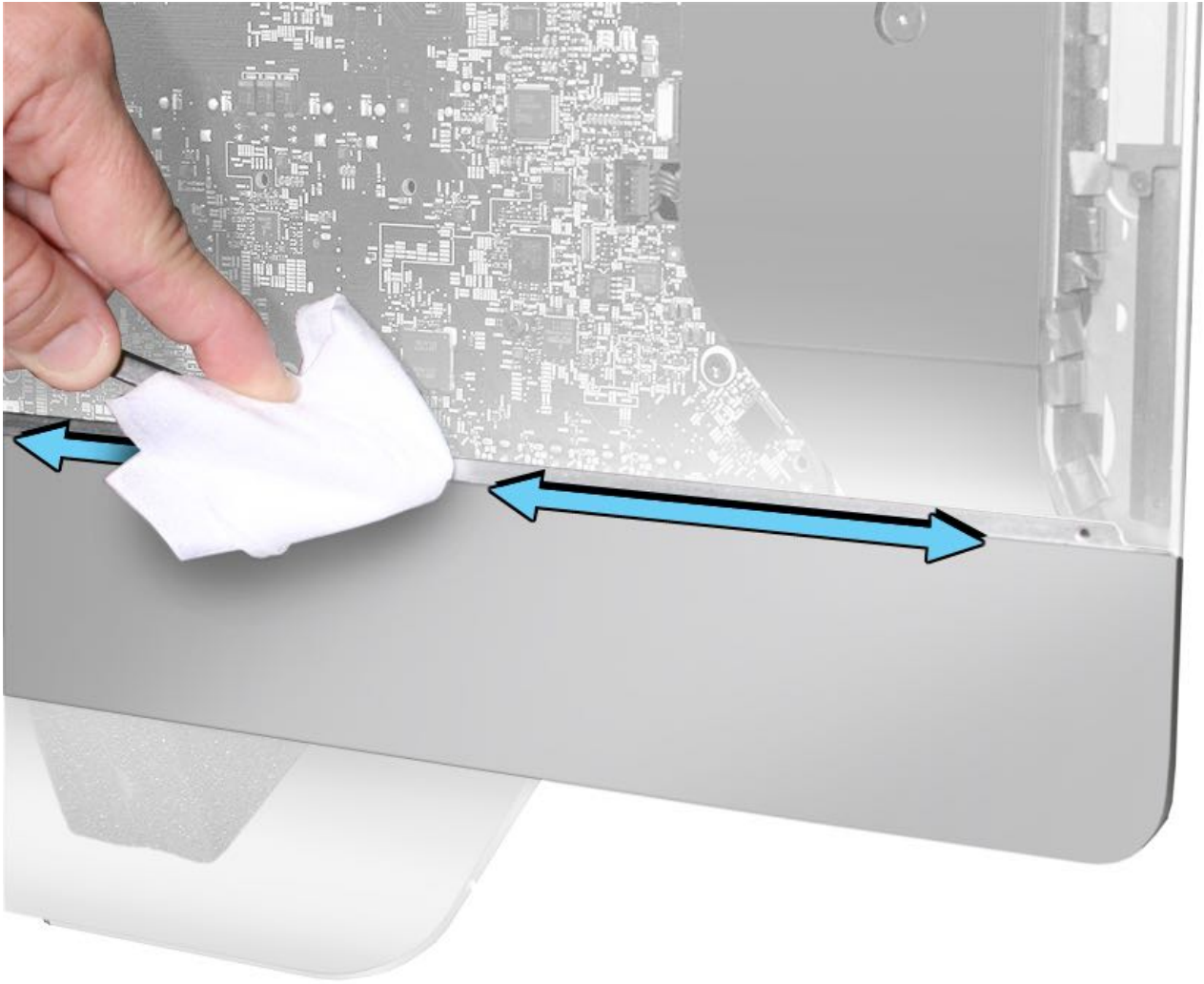
Do not peel VHB from the display corners. The chance of damaging the black Mylar protective film is greater if VHB removal is started in the corner.



5. Remove any remaining adhesive by wiping the rear housing and display panel edges clean with an IPA wipe. Continue

until the surfaces no longer show VHB residue.

Caution: Do not use IPA wipes on the display. IPA wipes should only be used to remove residual VHB adhesive. Be careful not to get IPA wipes on the display while removing the VHB residue.





6. Allow the surfaces to dry for one minute.

7. Check again to ensure that the display and rear housing are clean of VHB.

Steps For Reassembly

1. Install new [display panel VHB strips](#).
2. Reinstall the [display panel](#).

Display Panel - Replacing Very High Bond (VHB) Strips

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV116: Display Panel Removal and Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

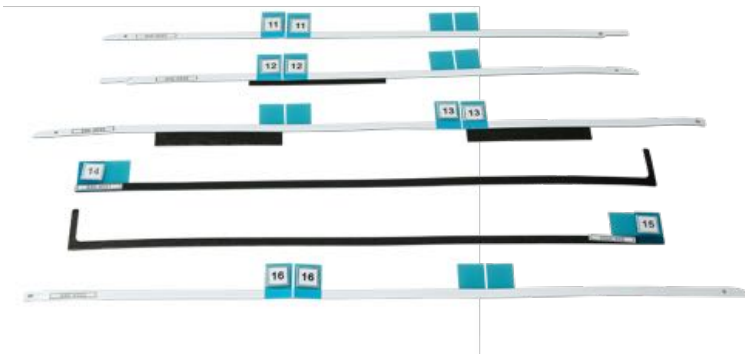


Tools

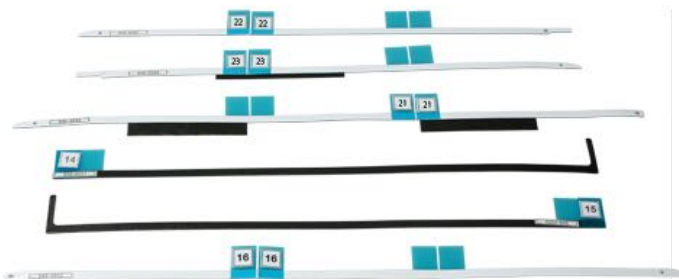
- ESD wrist strap and mat
- Black stick
- Service wedge (iMac)
- Display removal tool
- Display Refill Kit, VHB strips, 6-piece set, 20-pack (076-1419), for iMac (27-inch, Late 2012 and Late 2013)
- Display Refill Kit, VHB strips, 6-piece set, 20-pack (076-00009), for iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015)
- Display Refill Kit, VHB strips, 6-piece set, 20-pack (076-00332), for iMac (Retina 5K, 27-inch, 2017)



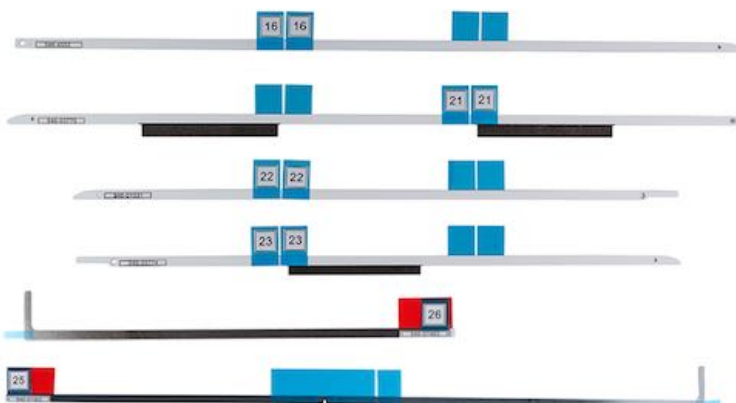
iMac (27-inch, Late 2012 and Late 2013) VHB strips



iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015) VHB strips



iMac (Retina 5K, 27-inch, 2017) VHB strips

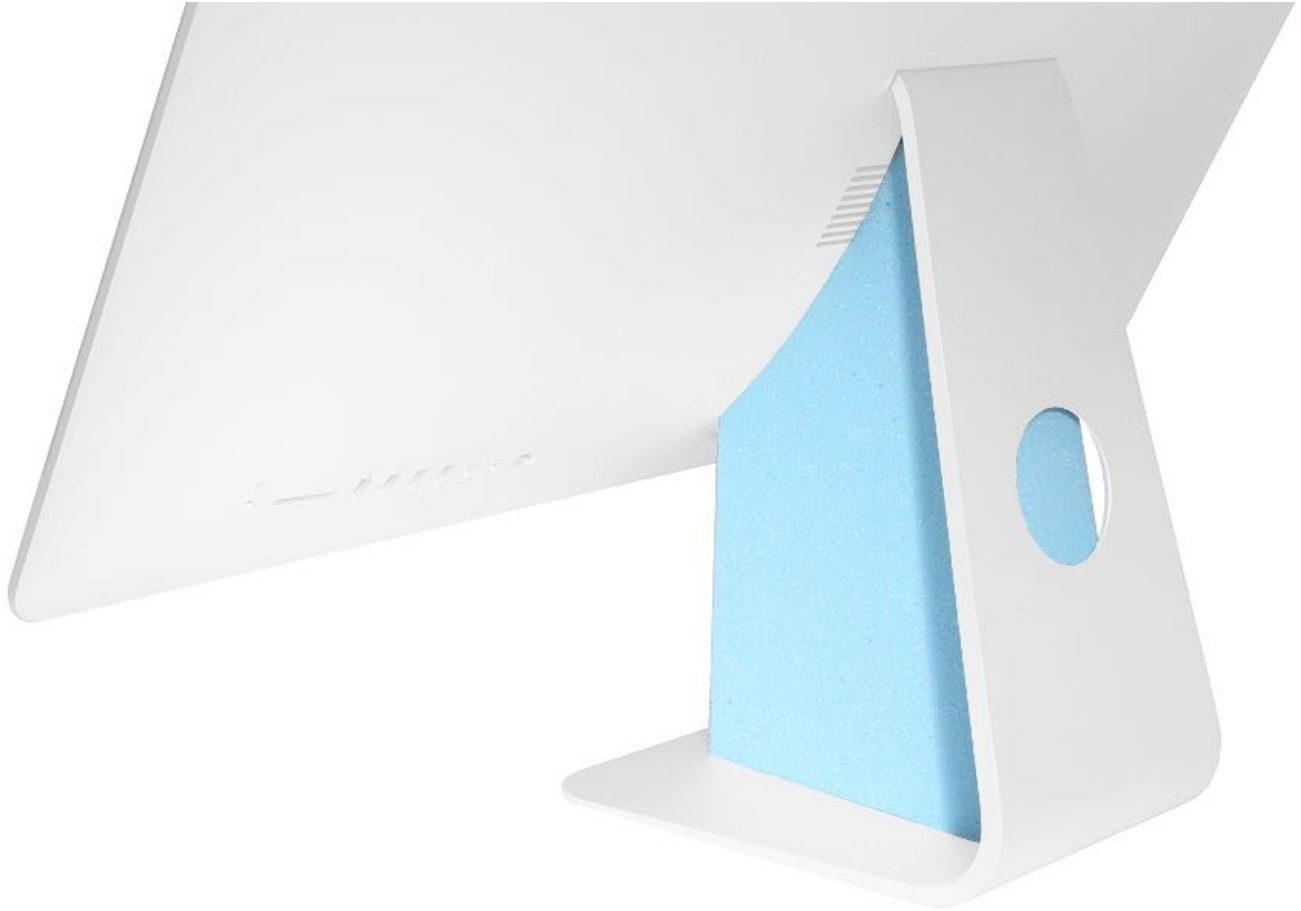


Steps For Removal

This is a reassembly instruction article. For removal steps, see article [RP998: Display Panel - Removing Very High Bond \(VHB\) Strips](#).

Steps For Reassembly

1. Insert the service wedge to hold the display steady. When positioned correctly, the wedge covers the power receptacle. Rotate the computer so the display panel is facing you.

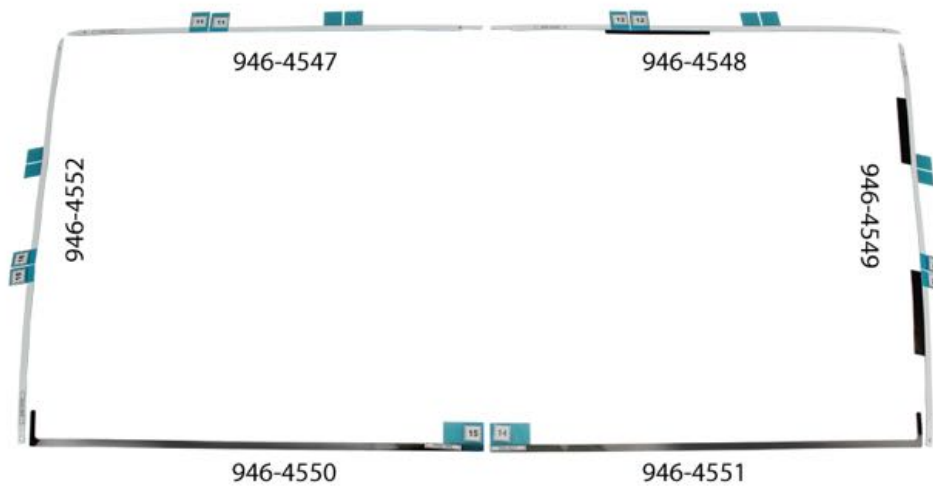


2. Each VHB strip has an ID number on the pull tab and part number (946-xxxx) printed on the strip. Use the tables and pictures below to verify that you have all of the needed VHB strips. Lay out the VHB strips before installing them onto the computer and check them for damage. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues, make the display bond weak, or create light leakage.

Note: The bottom left and right VHB strips on the iMac (2017) model are different from the bottom strips on the iMac (Late 2015) and older iMac models. The bottom right strip labeled 25 for iMac (2017) has a perforation in the VHB for the microphone hole. Make sure to use the correct strip and to line up the perforation with the microphone hole or it could lead to microphone issues.

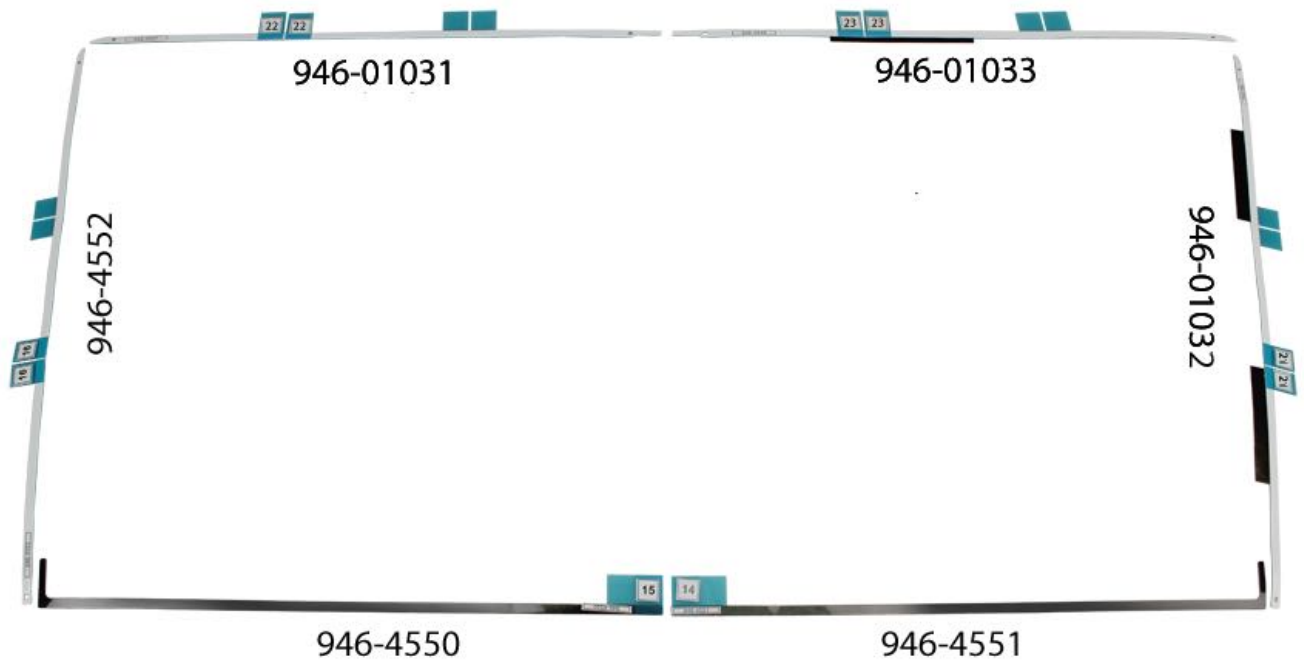
iMac (27-inch, Late 2012 and Late 2013) VHB strips:

VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	11	946-4547
Top right	12	946-4548
Right side	13	946-4549
Bottom right	14	946-4551
Bottom left	15	946-4550
Left side	16	946-4552



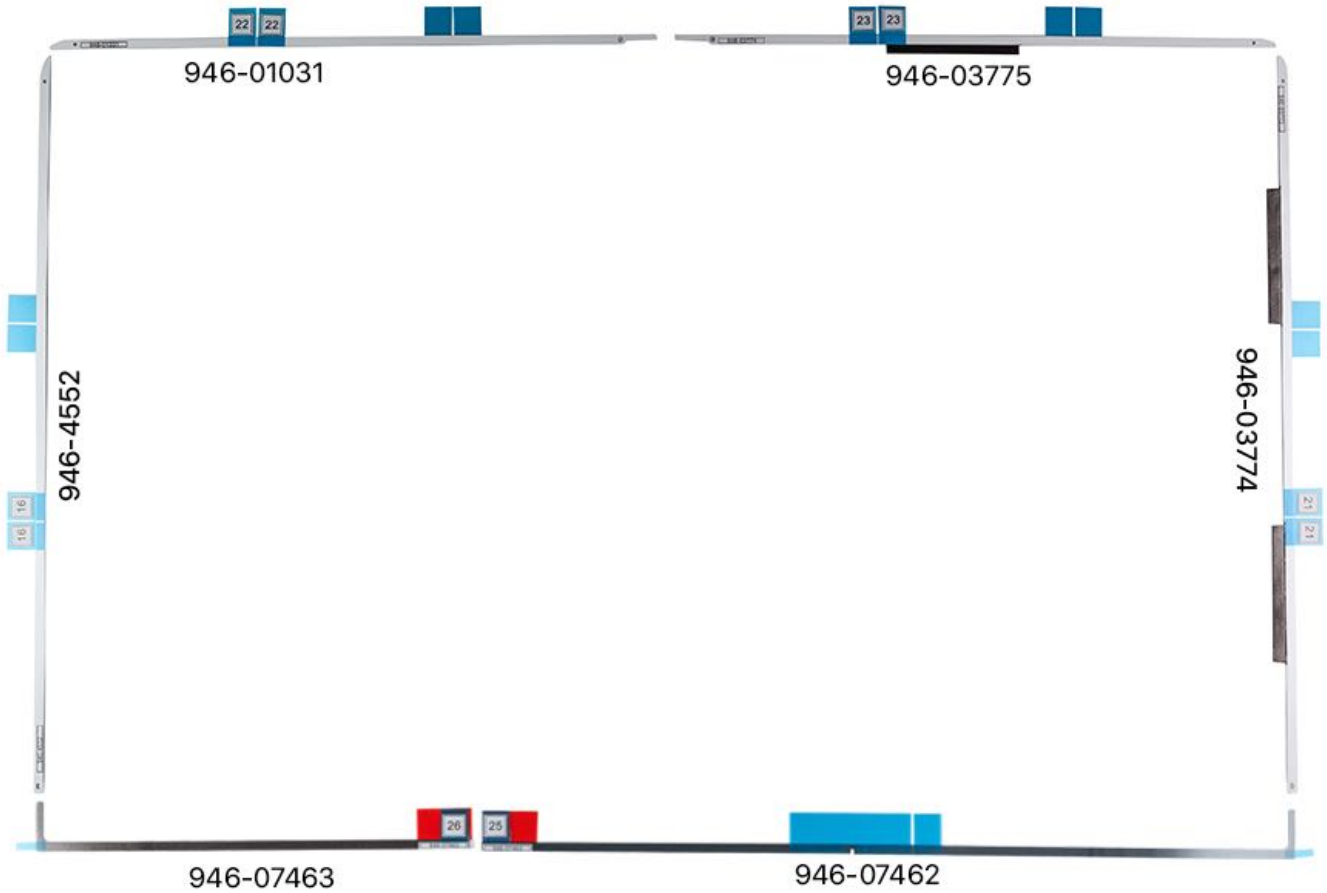
iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015) VHB strips:

VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	22	946-01031
Top right	23	946-01033 (alternate 946-03775)
Right side	21	946-01032 (alternate 946-03774)
Bottom right	14	946-4551
Bottom left	15	946-4550
Left side	16	946-4552

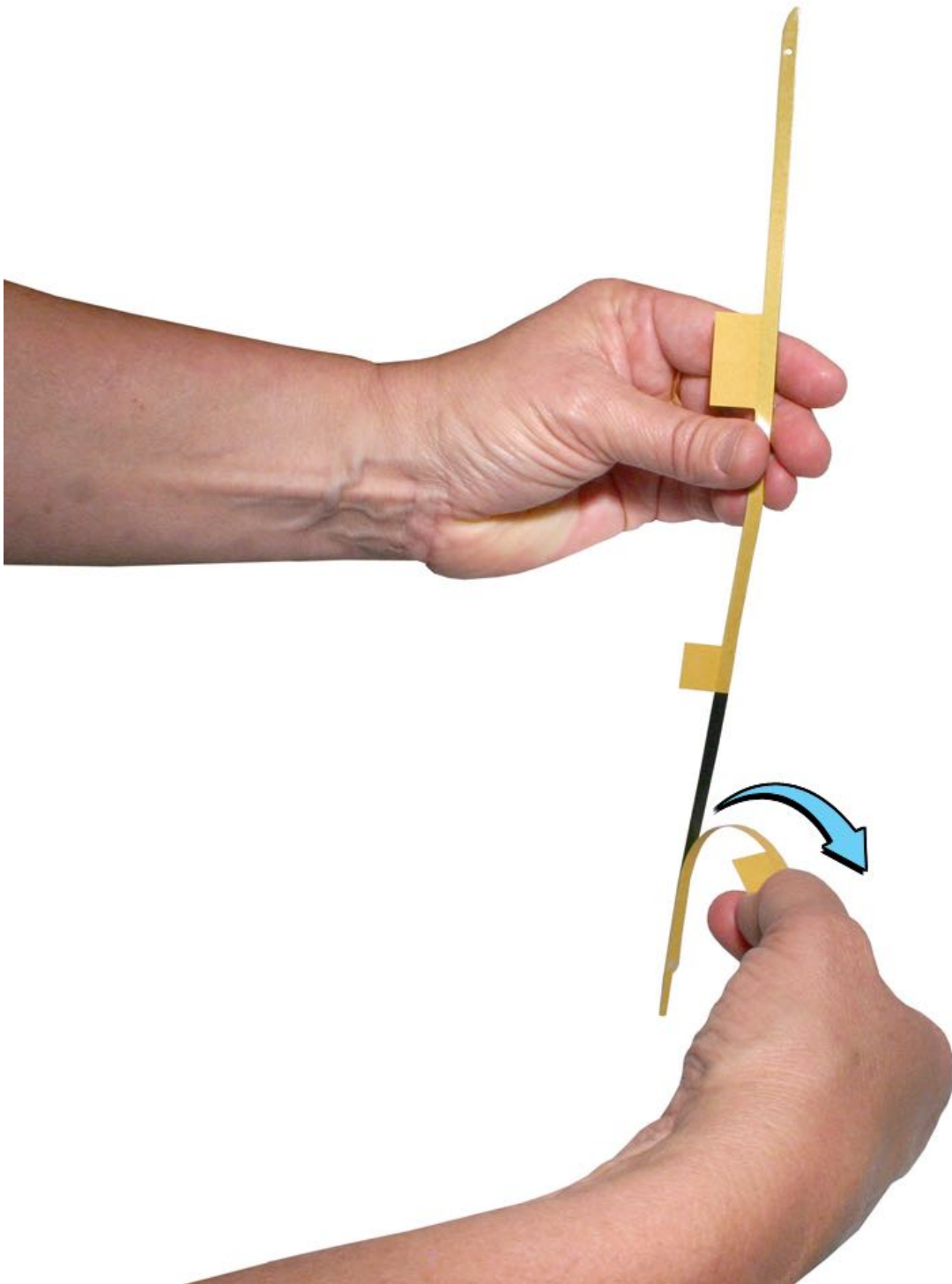


iMac (Retina 5K, 27-inch, 2017) VHB strips:

VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	22	946-01031
Top right	23	946-03775
Right side	21	946-03774
Bottom right	25	946-07462
Bottom left	26	946-07463
Left side	16	946-4552

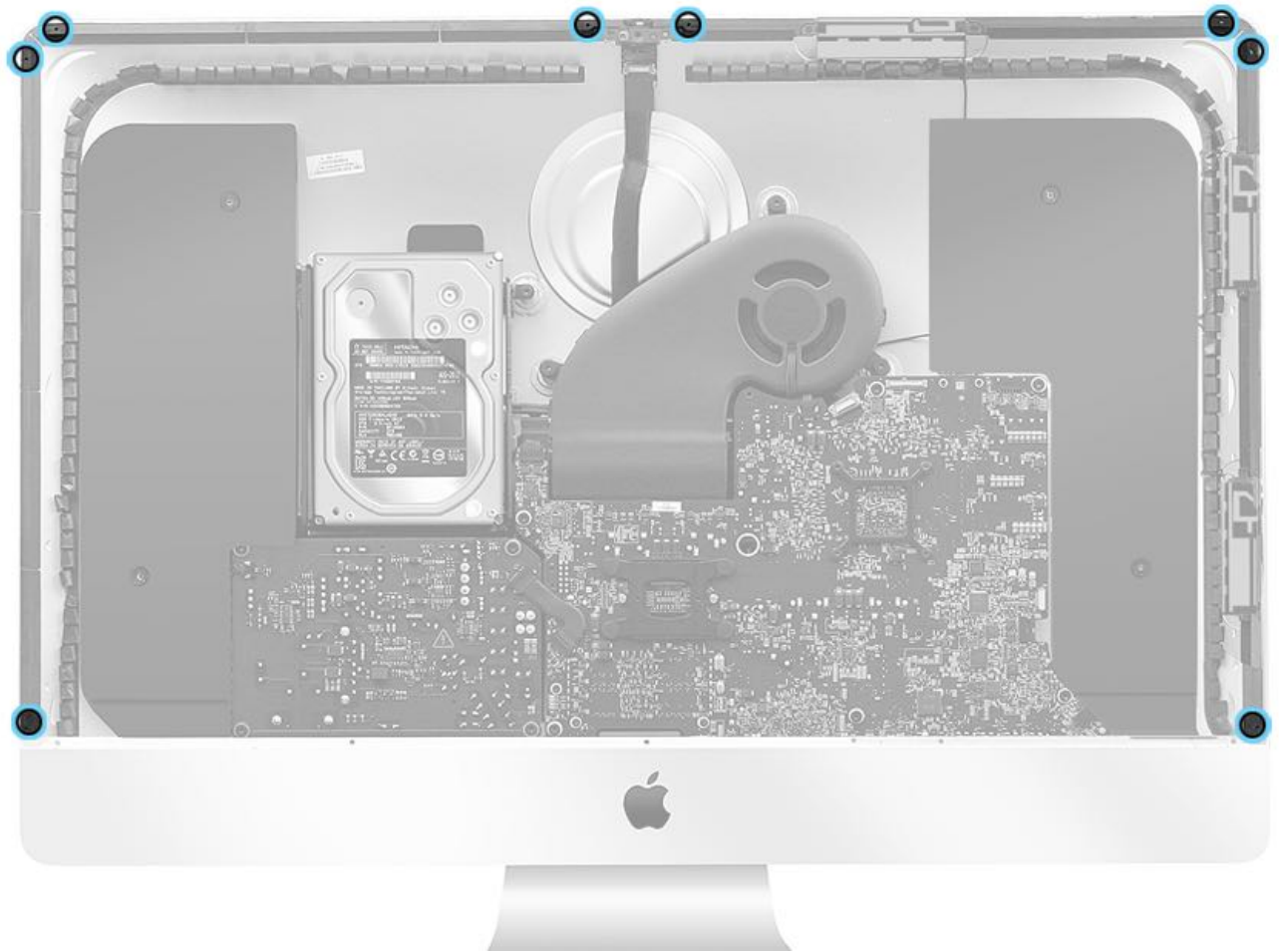


3. The VHB strips have a foam layer (VHB/foam/VHB), with a removable liner on the underside and a clear plastic liner on the top side. The image below shows the process of peeling the paper liner off the underside of the VHB strip. **Note:** The color of the removeable liner may vary between VHB vendors.



4. The rear housing has eight alignment holes. Use them to align the new VHB strips.

Note: Before adhering the VHB strips and installing the display, verify that all cables are connected, all screws are installed, and that there is no debris present in the computer.



5. Peel the paper backing off of one portion of the VHB strip. **Note:** The more recent VHB strips are a teal blue color. Some of the procedures that follow show older VHB strips, which are an orange color. The replacement VHB process is the same regardless of color.





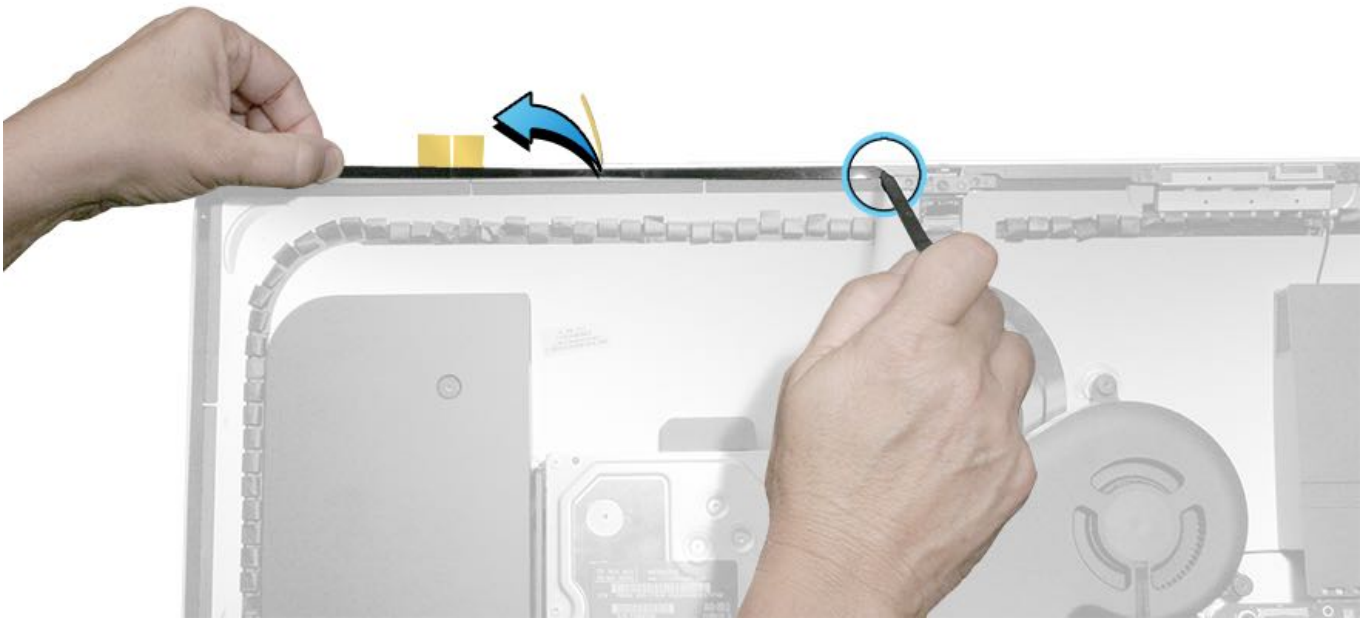
6. Use the pointed end of a black stick to align the VHB strips on the rear housing. **Note:** The paper liner side faces the rear housing.
7. As you position the VHB, use your finger to peel the remaining paper liner from the underside of the VHB strip.
8. Use your finger to press the VHB strip into place on the rear housing. **Note:** If a VHB strip does not line up correctly, remove it and start again.
9. Do not remove the clear plastic liners from the top layer of the strip at this time. Remove them right before you replace the panel.



10. Insert the pointed end of a black stick into another alignment hole and peel the paper backing off of the strip. Press down with your finger to adhere the strip to the rear housing.



11. Repeat the VHB process (align, peel paper liners, press VHB into place) along the top edge of the rear housing. Press with your fingers to adhere the strips to the rear housing.

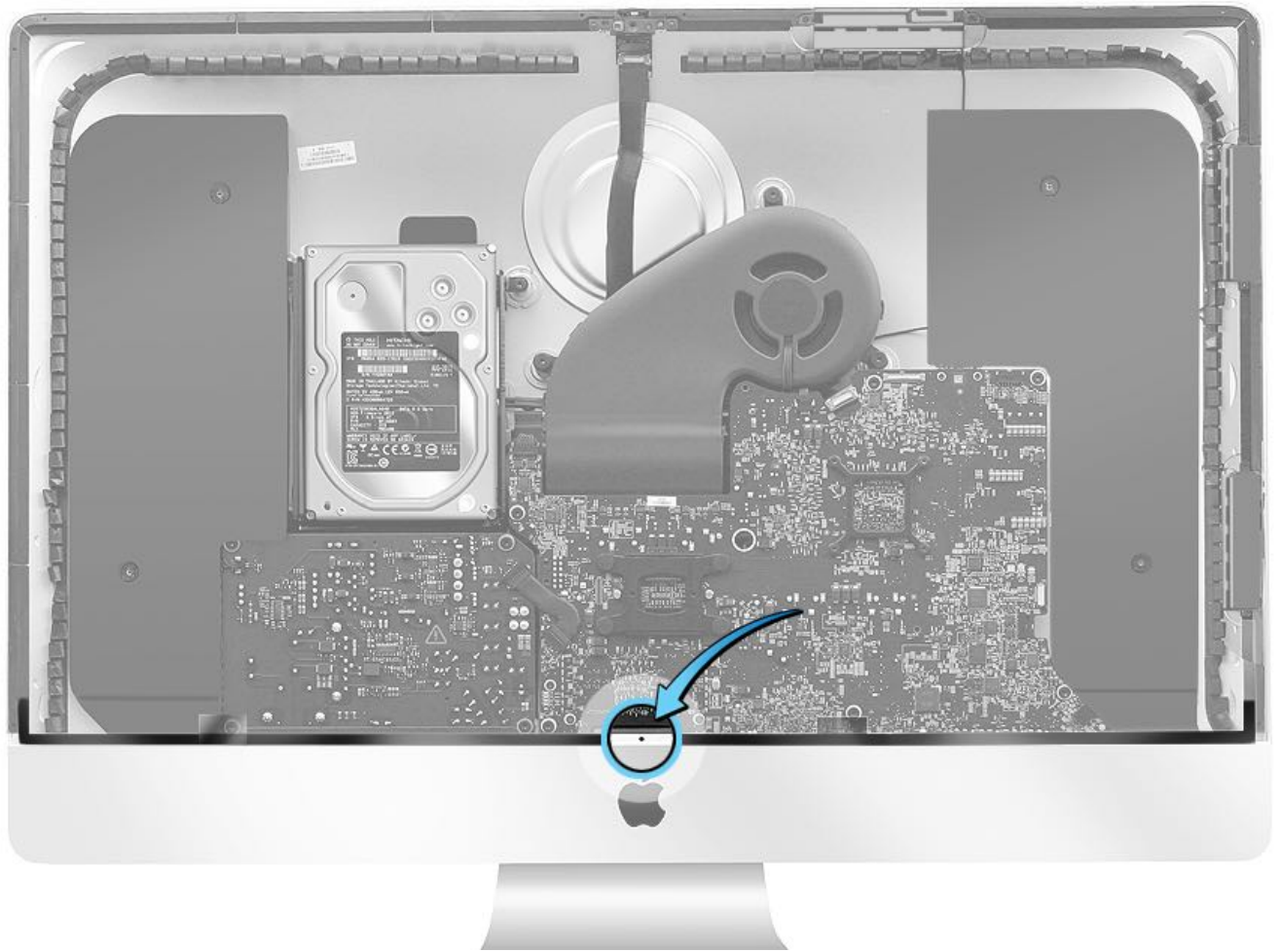


12. Two strips of VHB are used along the bottom edge. There are no guide holes on the VHB strip or rear housing for the bottom strips. Align the strips carefully by hand.

Important: The bottom VHB strips on the iMac (2017) are different from the bottom strips on the iMac (Late 2015) and older models. The bottom right strip labeled 25 for iMac (2017) has a perforation in the VHB for the microphone hole, refer to image below. Make sure to use the correct strip and line up the perforation with the microphone hole or it could lead to microphone issues.

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015)

Align the VHB strips on the bottom edge, positioning the VHB strips to the left and right of the center screw hole. **Note:** The angled end of the VHB strip attach to the rear housing, and should not overlap the VHB strips on the sides.

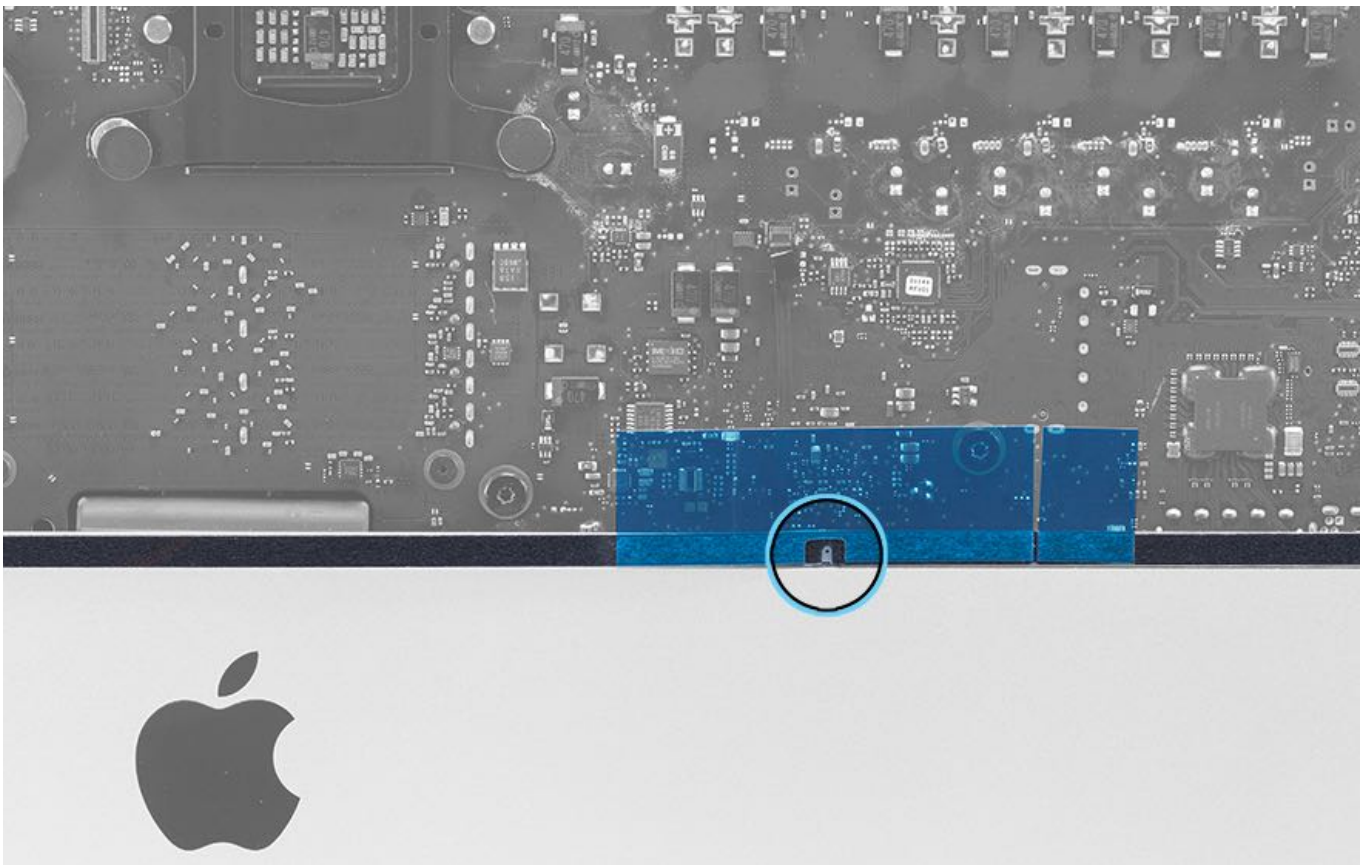


iMac (Retina 5K, 27-inch, 2017)

Start replacement with VHB strip 25. Align the small perforation (see the second image) on the VHB strip with the microphone hole on the chin. **Important:** Make sure to use the correct strip and line up the perforation with the microphone hole or it could lead to microphone issues.



iMac (Retina 5K, 27-inch, 2017) VHB Close Up of Perforation For Microphone



13. **Note:** If any VHB strip does not line up correctly, then remove it, clean the rear housing, and start again. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues and may make the display bond weaker or create light leakage.

14. To install the display panel, refer to [RP1000: Display Panel Reassembly](#).

Display Panel Reassembly

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV116: Display Panel Removal and Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

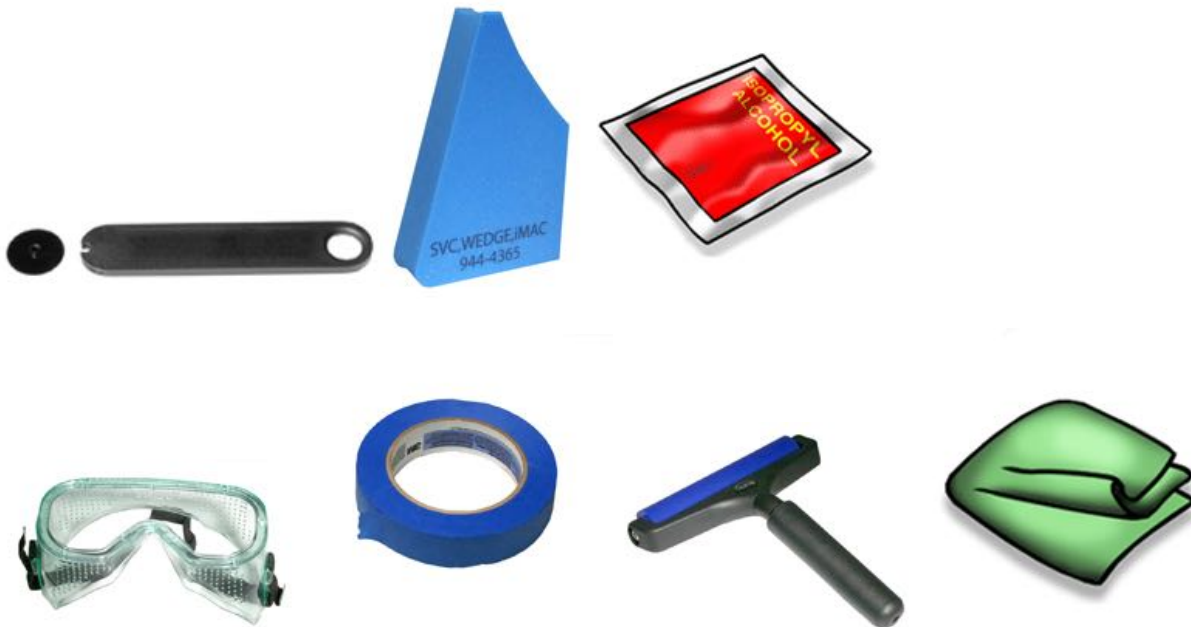
Replace:

- [Display panel VHB strips](#)



Tools

- Display removal tool
- Service wedge (iMac)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)
- Safety glasses
- Painter's tape (tape that does not leave a residue, 1 to 2 inches wide, preferably 2 inches, if available)
- Silicone display roller
- Clean, damp, lint-free cloth (to clean display panel glass)



Steps For Removal

This is a reassembly instruction article. Before you begin, refer to the following articles:

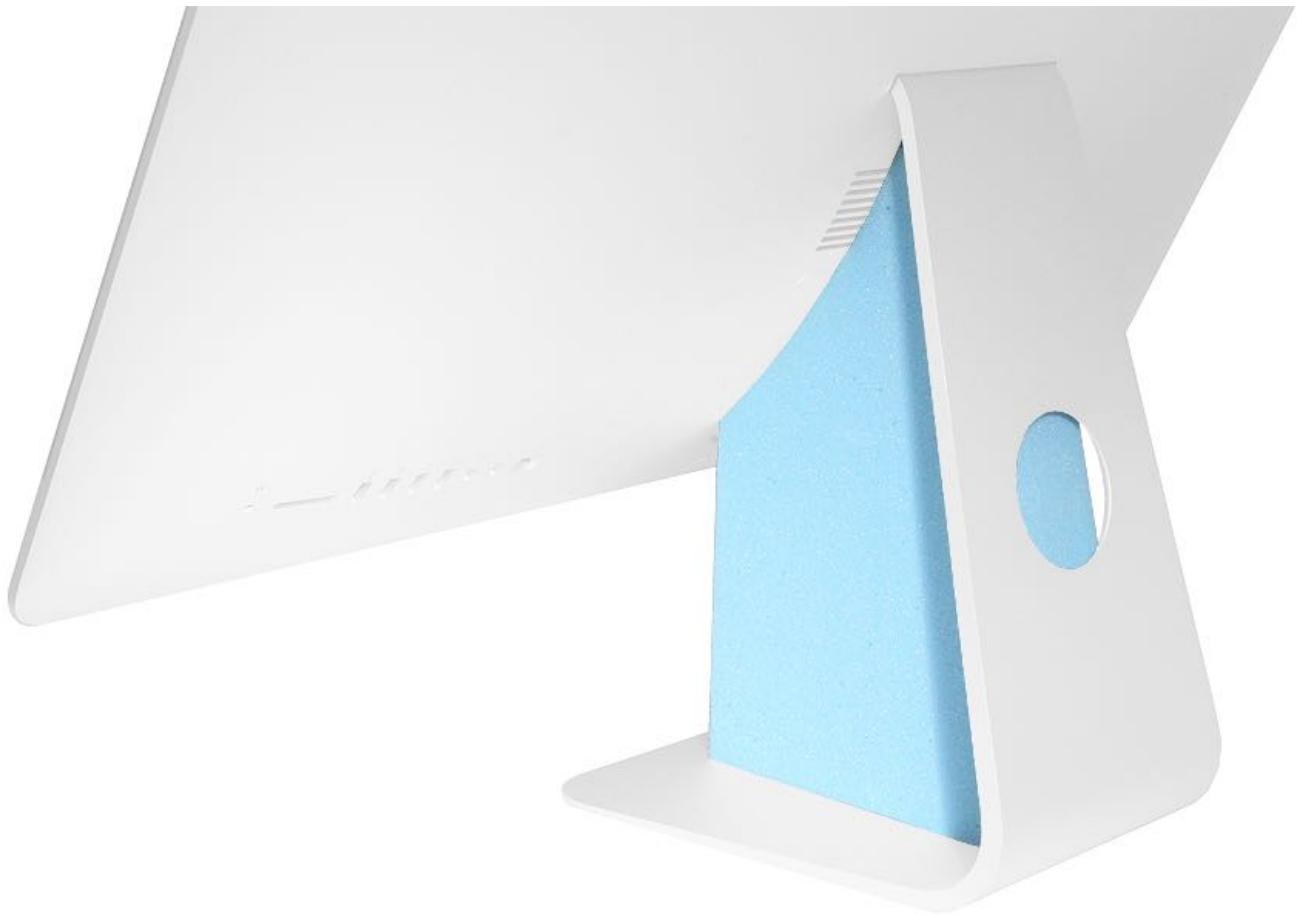
- [RP950: Display Panel Removal](#)
- [RP998: Display Panel - Removing Very High Bond \(VHB\) Strips](#)
- [RP999: Display Panel - Replacing Very High Bond \(VHB\) Strips](#)

If you have already performed the removal and replacement tasks listed above, then proceed to the next step.

Steps For Reassembly

Important: In the unlikely event that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Insert the service wedge to hold the display steady for this procedure. When positioned correctly, the wedge covers the power receptacle.



2. Before installing, ensure that any residual VHB is removed from the display panel and rear housing.



3. Place the display panel on the chin of the rear housing. Align the panel and check that it is centered and seated.



4. Use the display removal tool to check the alignment on both sides of the display. Adjust if necessary.



5. Anchor the display with a strip of painter's tape. Place it over the bottom of the display and the edge of the rear housing.



6. Stand back to check the alignment of the display panel. If the rear housing can be seen, then adjust the panel and check again.

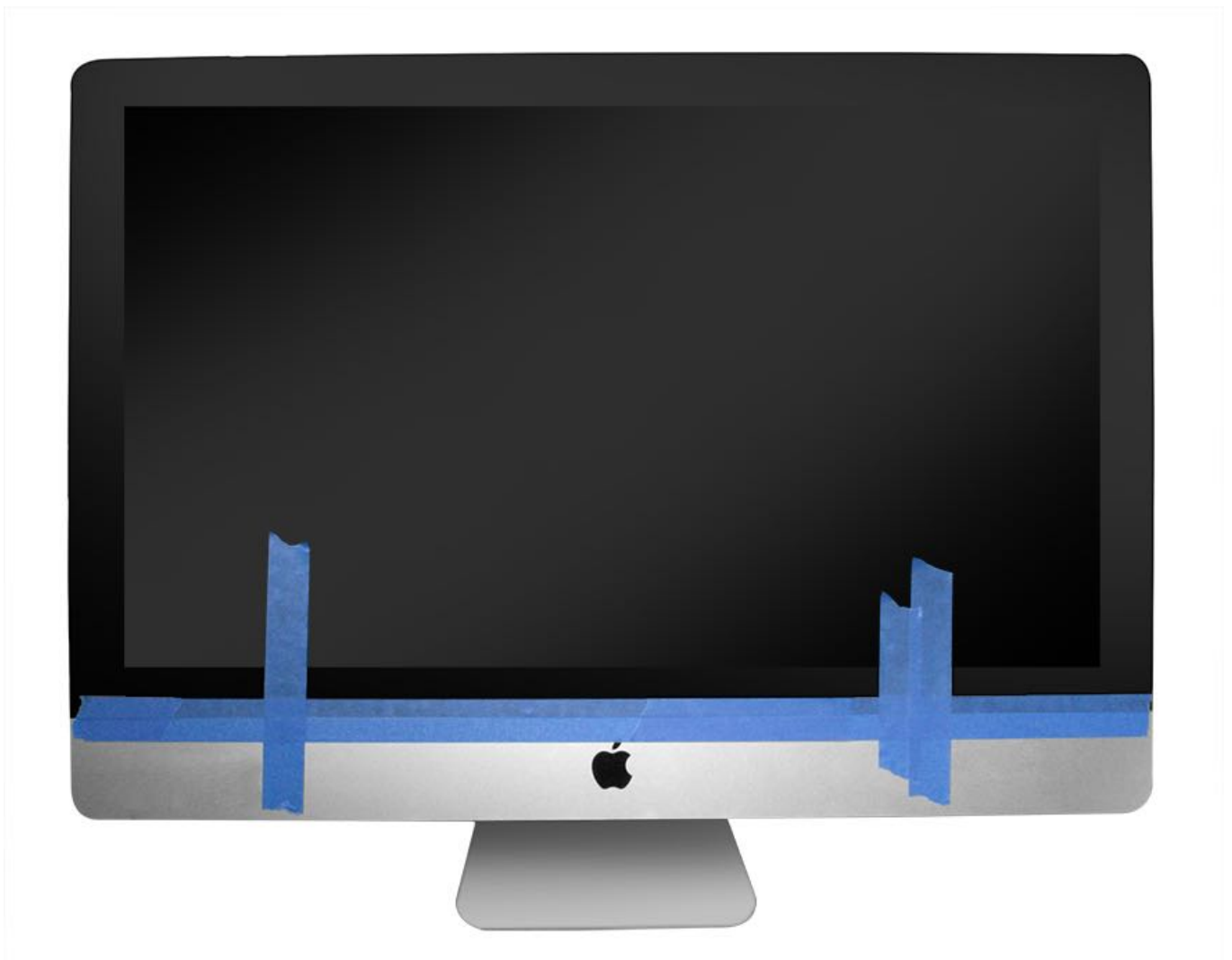
Incorrect alignment



Correct alignment



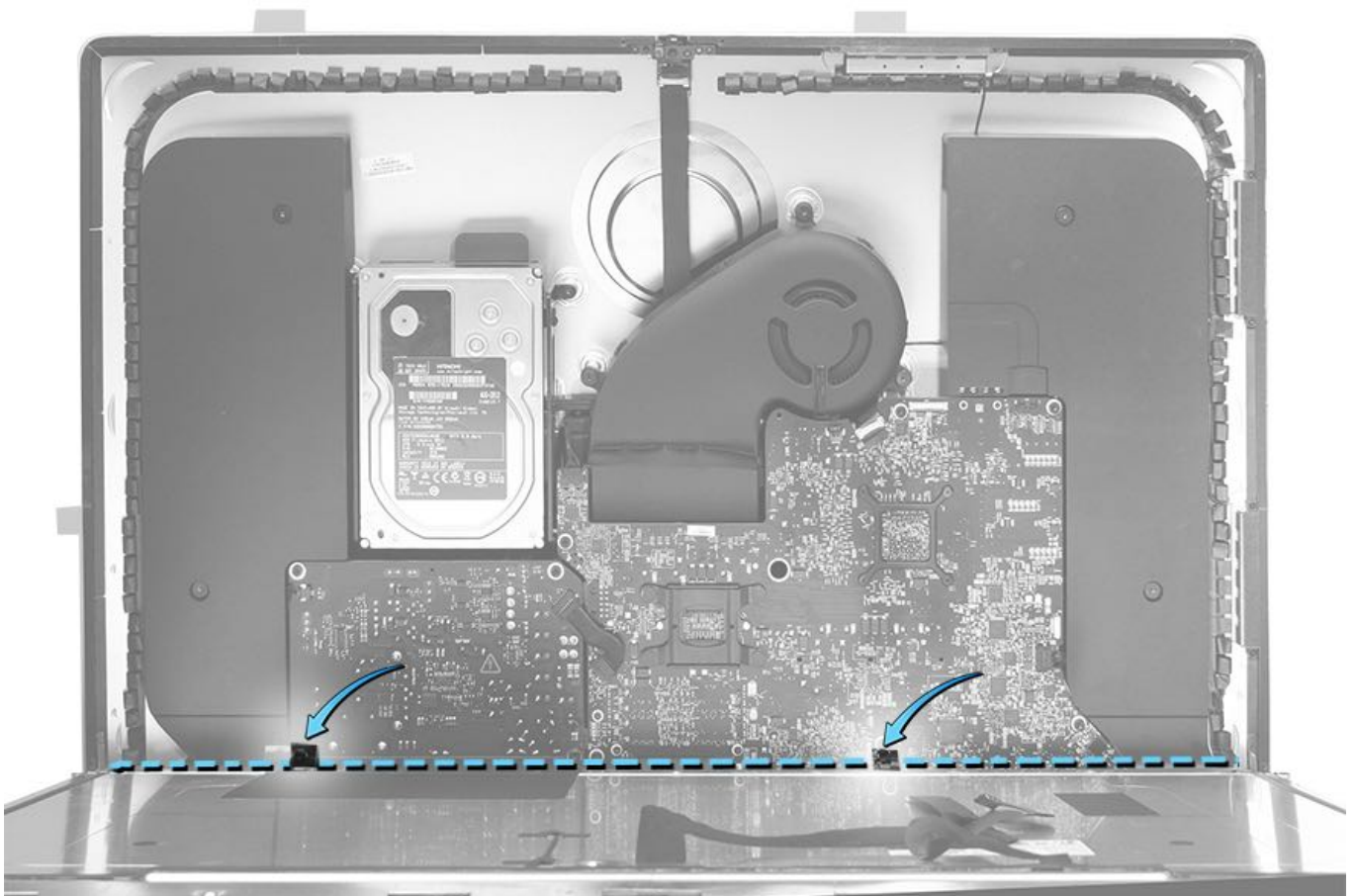
7. Anchor the display further with more strips of painter's tape. Place one or two vertical pieces along the edge for added support.



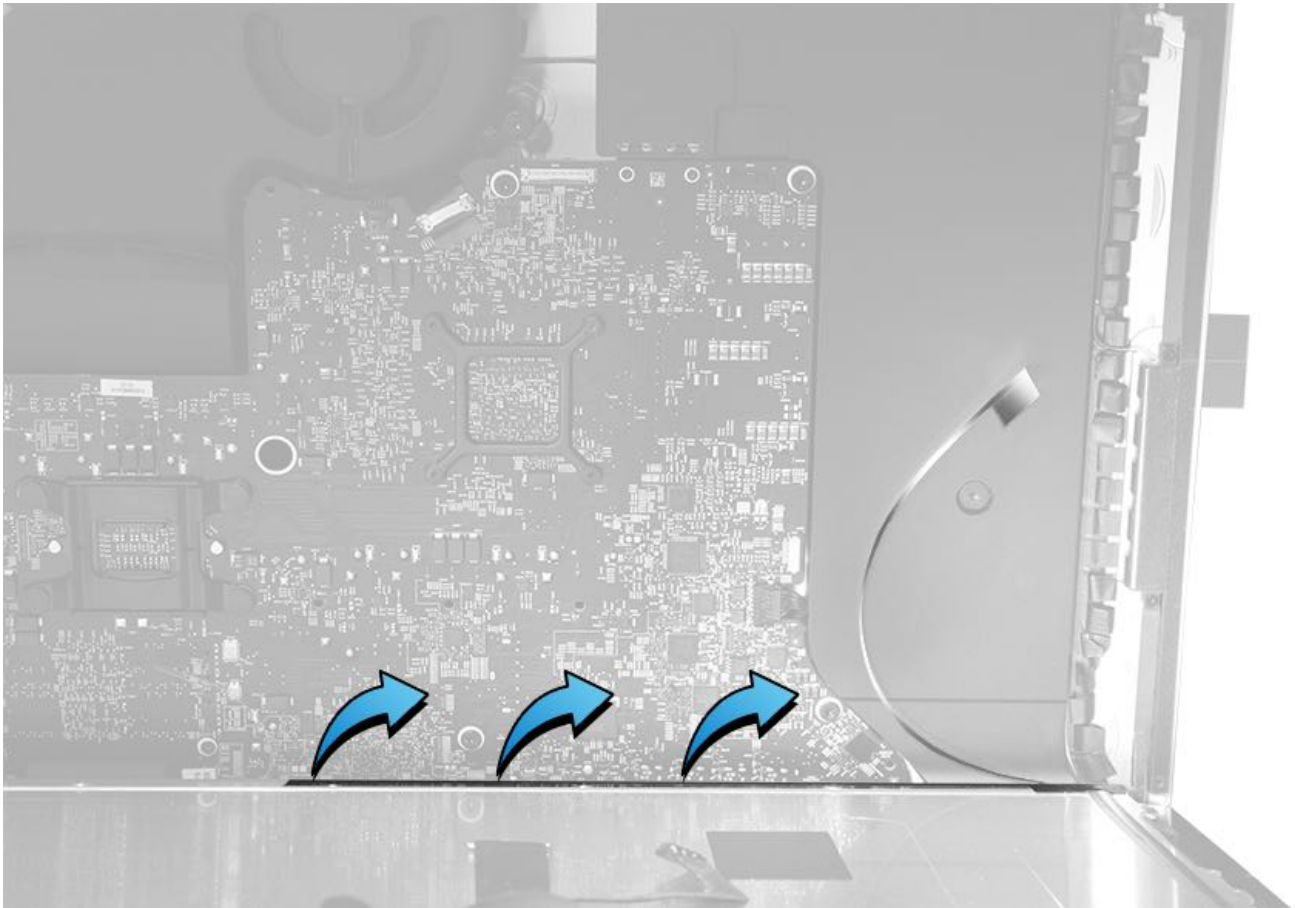
8. Use one hand to tilt the display forward.



9. Use the other hand to pull the clear release liners on the bottom VHB strips. Pull the release liners carefully so they do not tear or break.

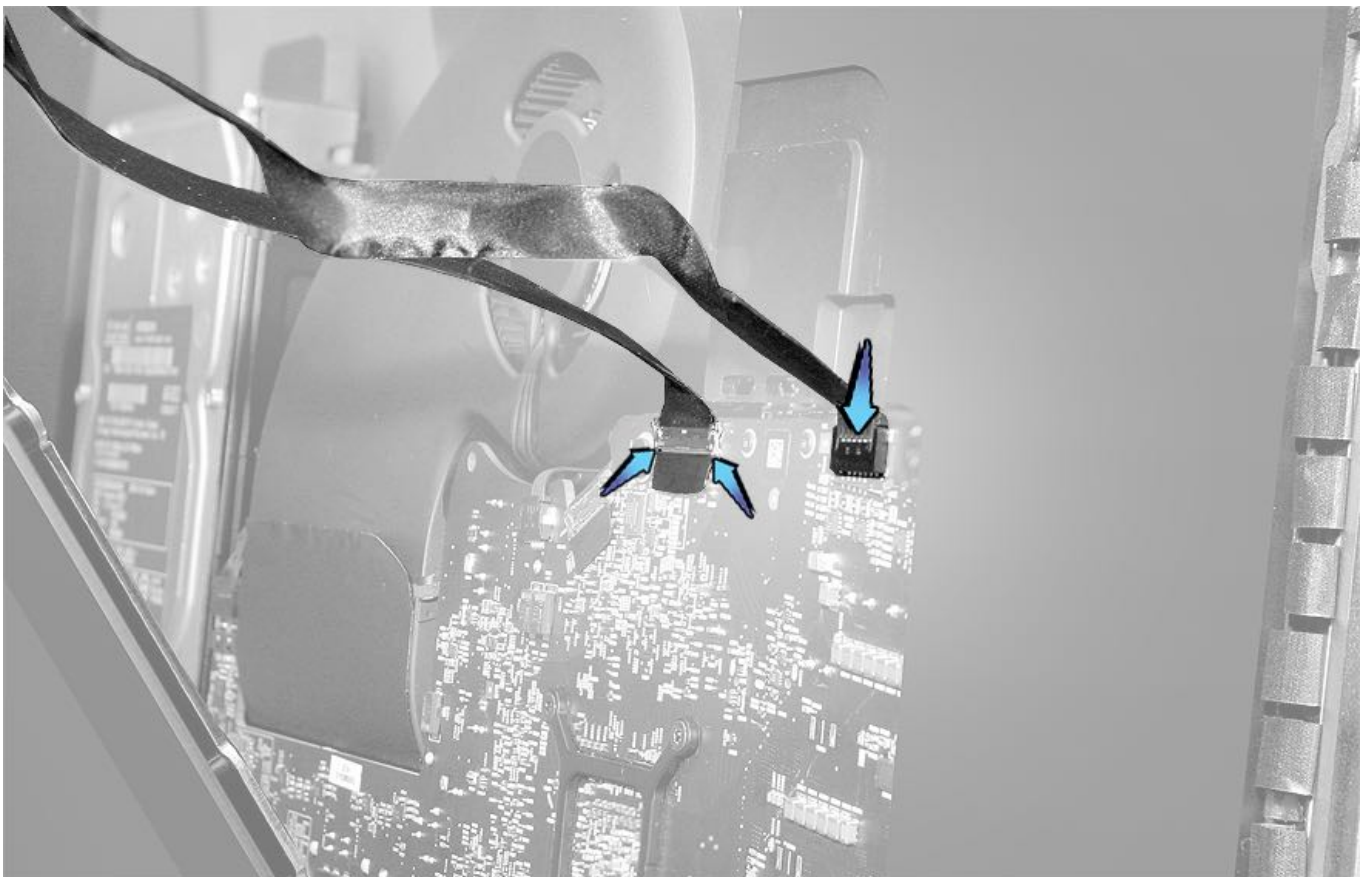


A closer view of the bottom release liner:

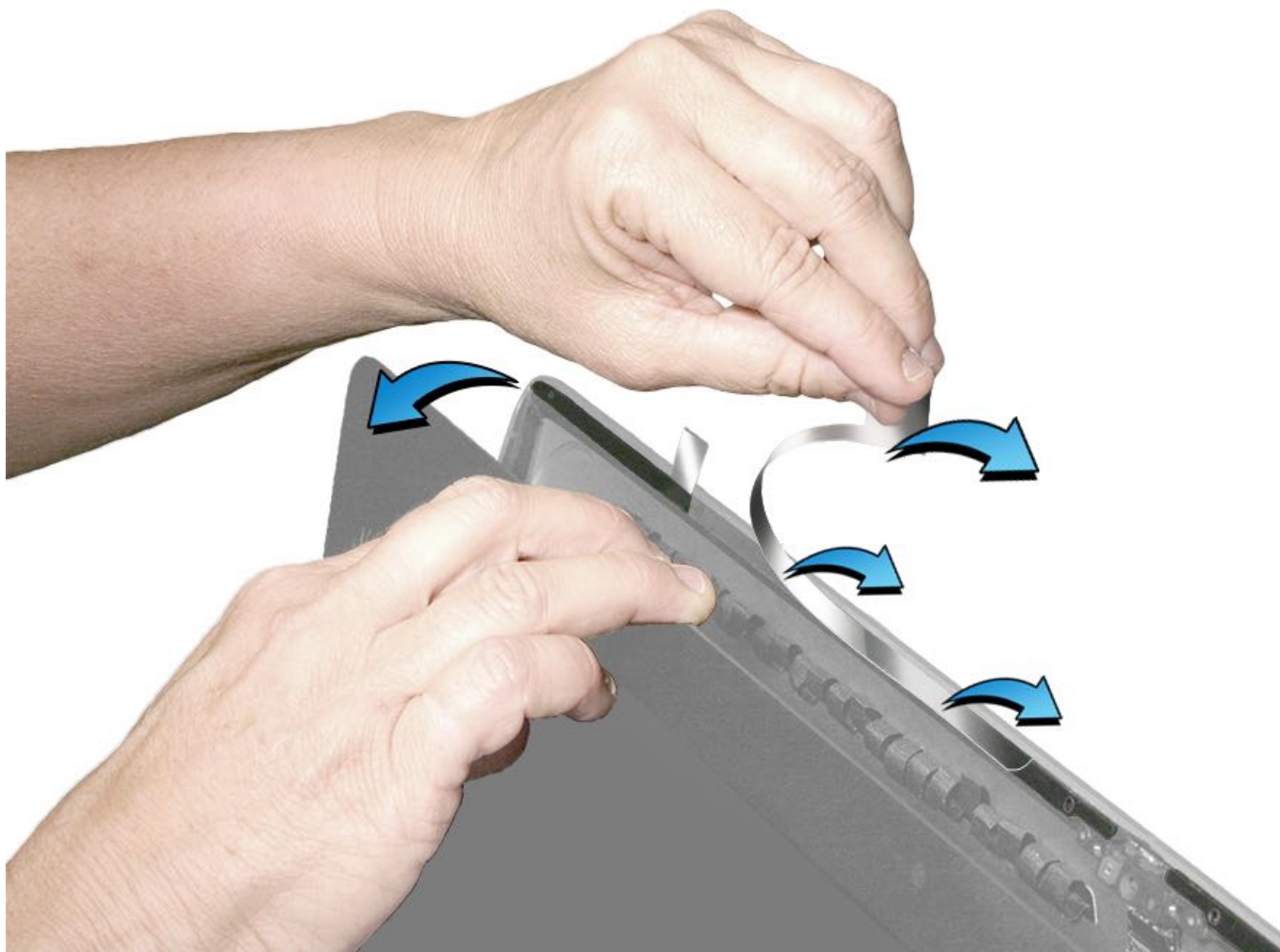


10. Tilt the display up, leaving enough room to connect the display power and Embedded DisplayPort (eDP) cables to the logic board. If these cables are not connected properly, it could result in no video or no power. Check that the connectors are firmly seated.

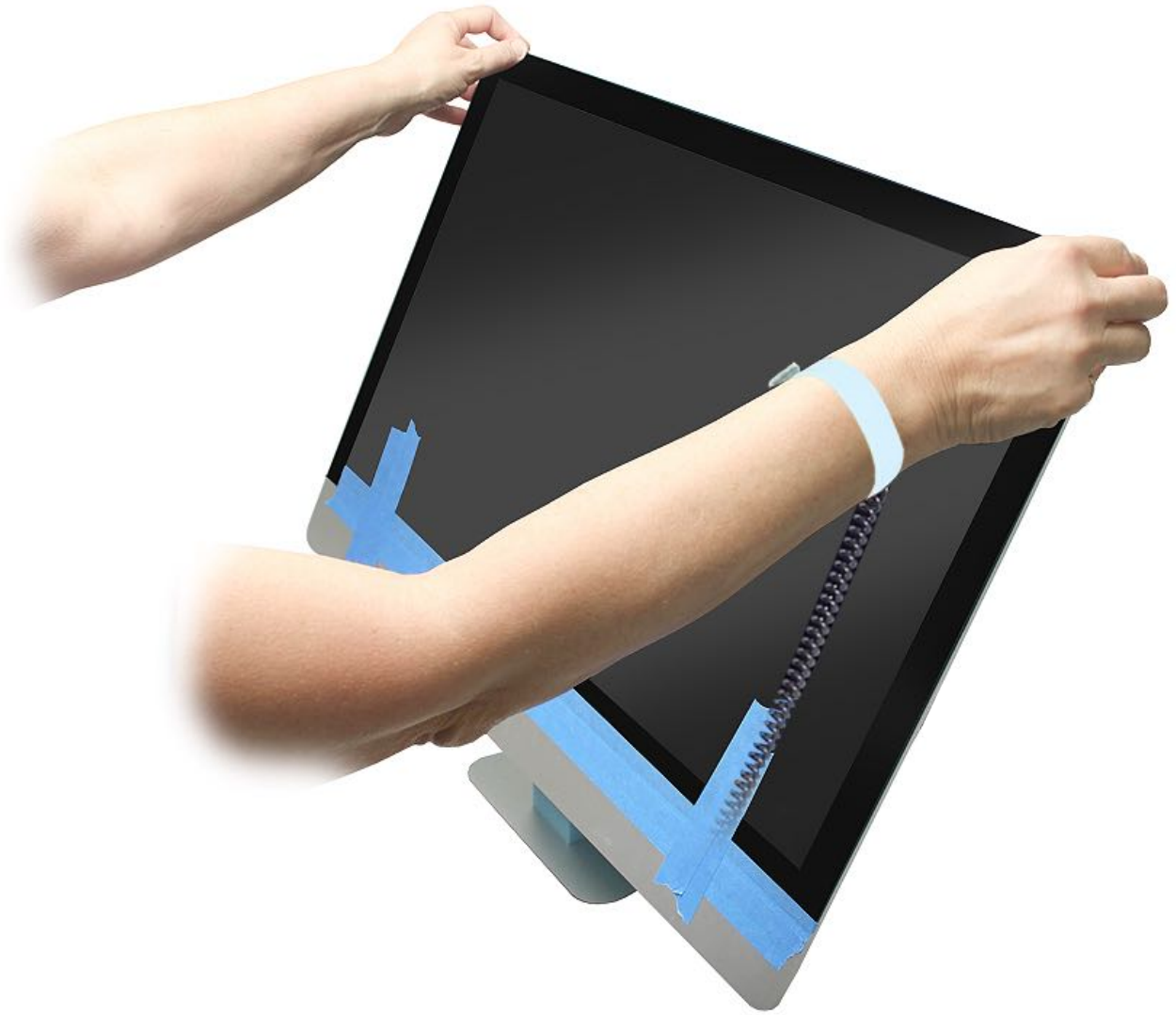
Important: Be extremely careful not to stress the display cables and connectors on the logic board when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, then the logic board will need to be replaced.



11. Remove the remaining release liners from the top and sides of the display panel.

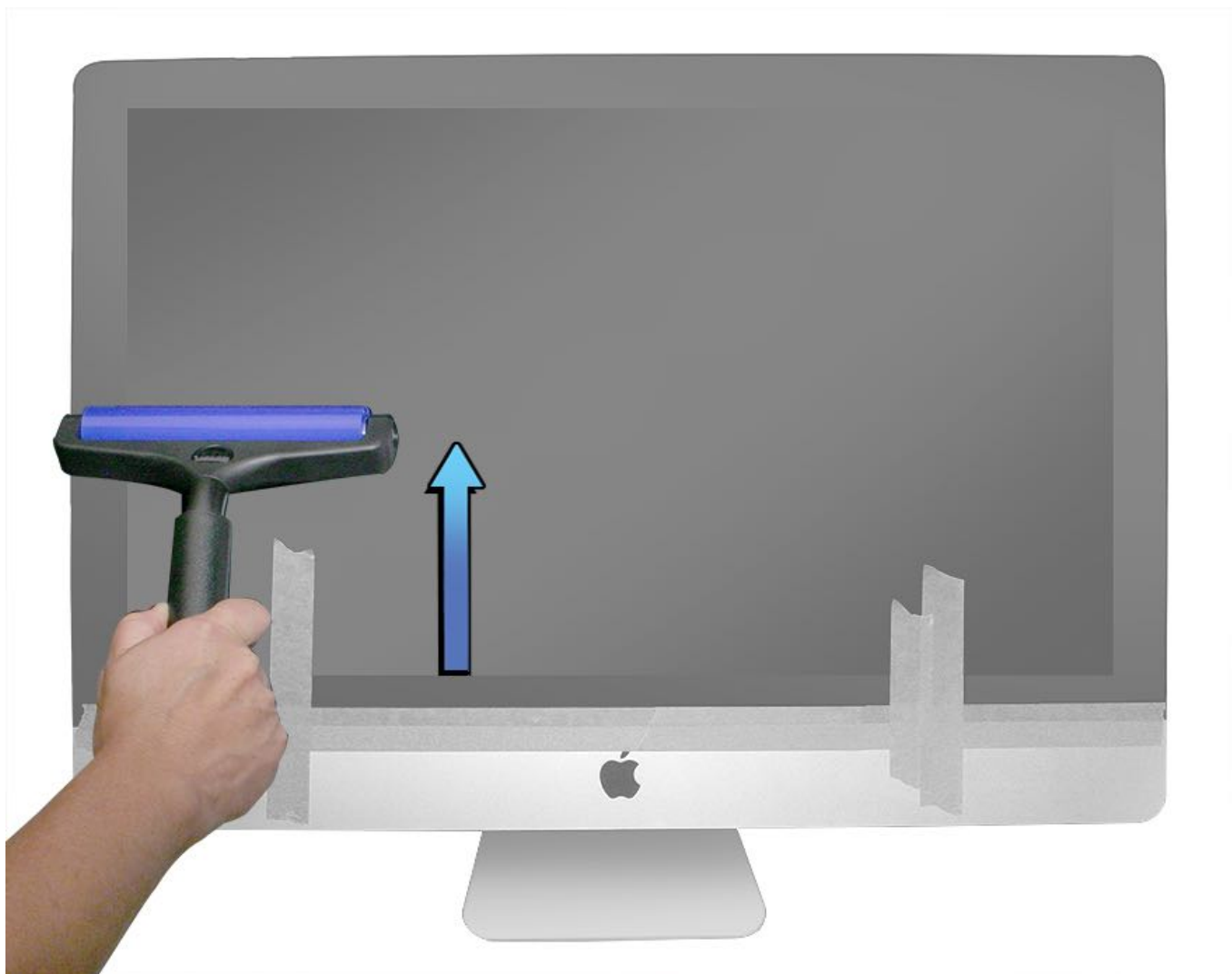


12. After all the release liners have been removed, lower the display panel against the rear housing.

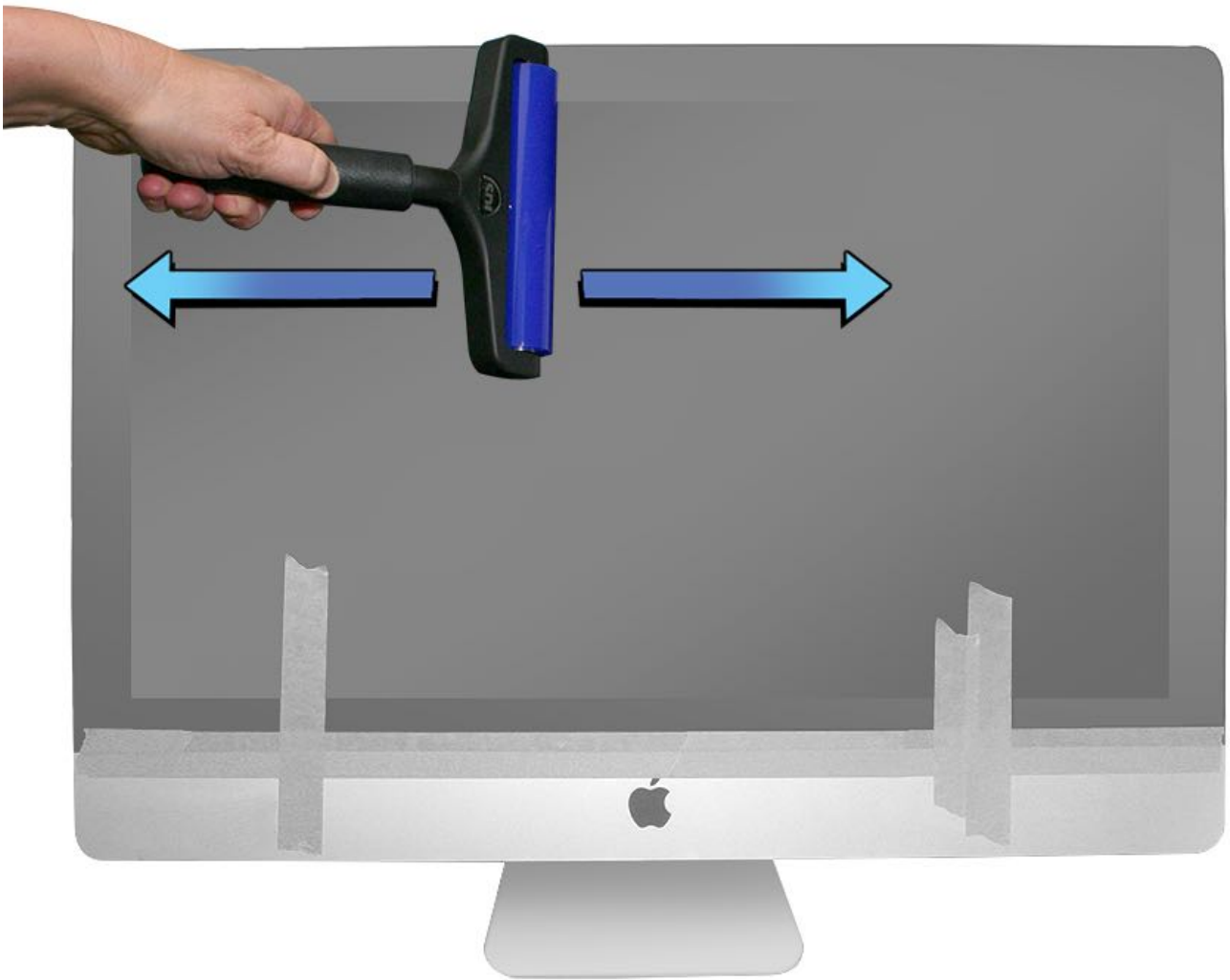


13. Use the silicone display roller to adhere the VHB strips to the glass. Roll the edges of the glass panel from the bottom to the top.

Note: Do not roll up and down.



Repeat the rolling along the top and the other side.



14. Remove the painter's tape.



15. Clean the front of the display with a clean, damp, lint-free cloth.

Note: Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.



Embedded DisplayPort (eDP) Cable

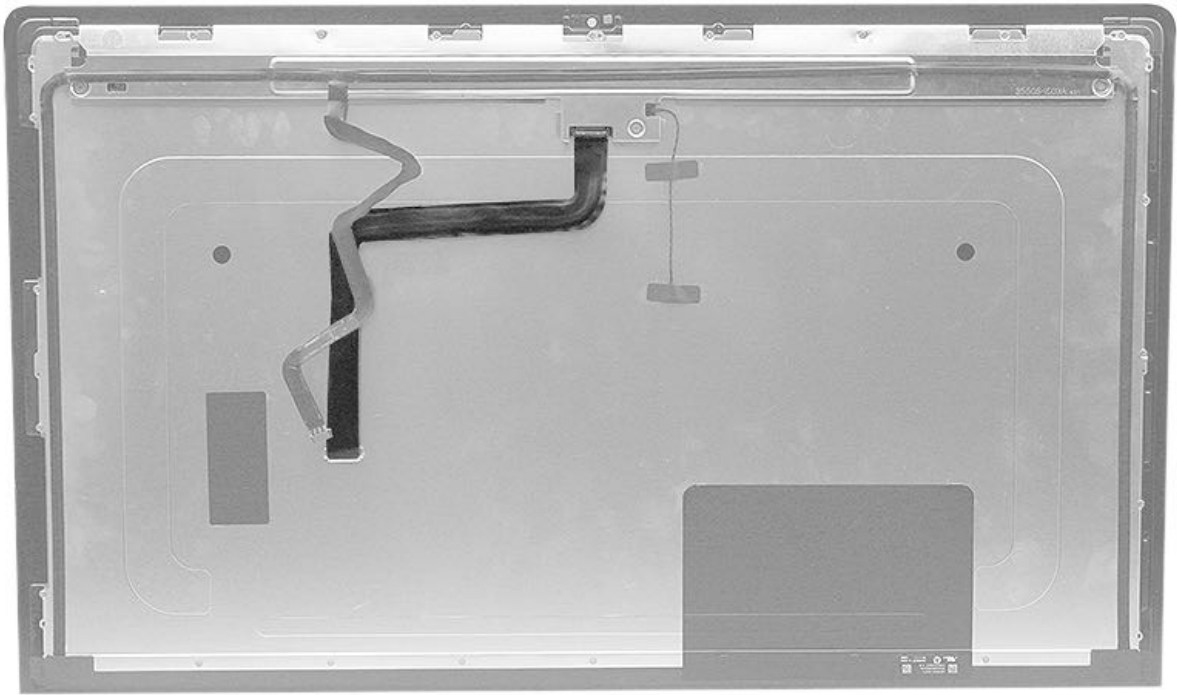
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

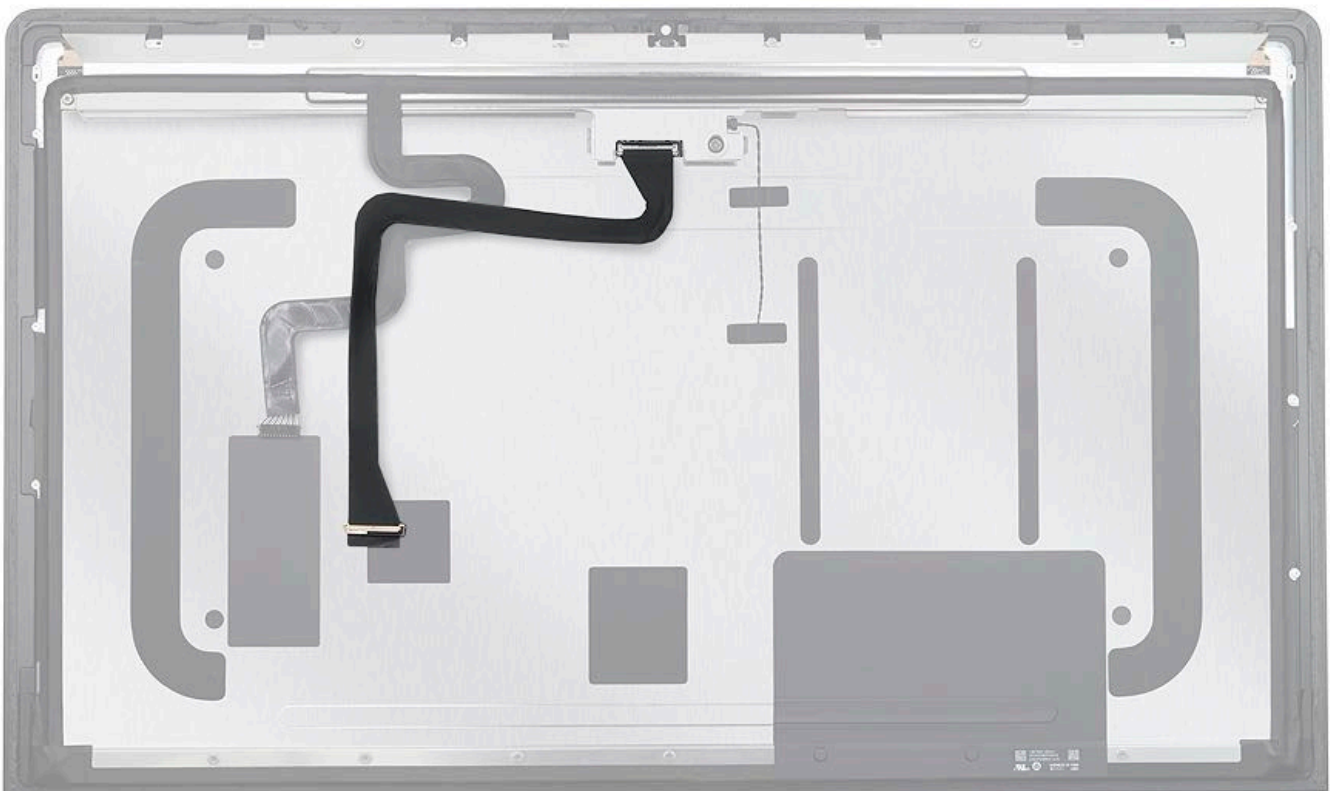
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

iMac (27-inch, Late 2012 and Late 2013)

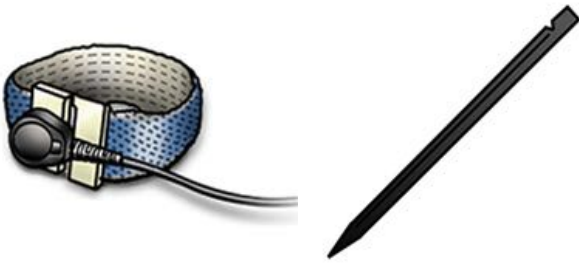


iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



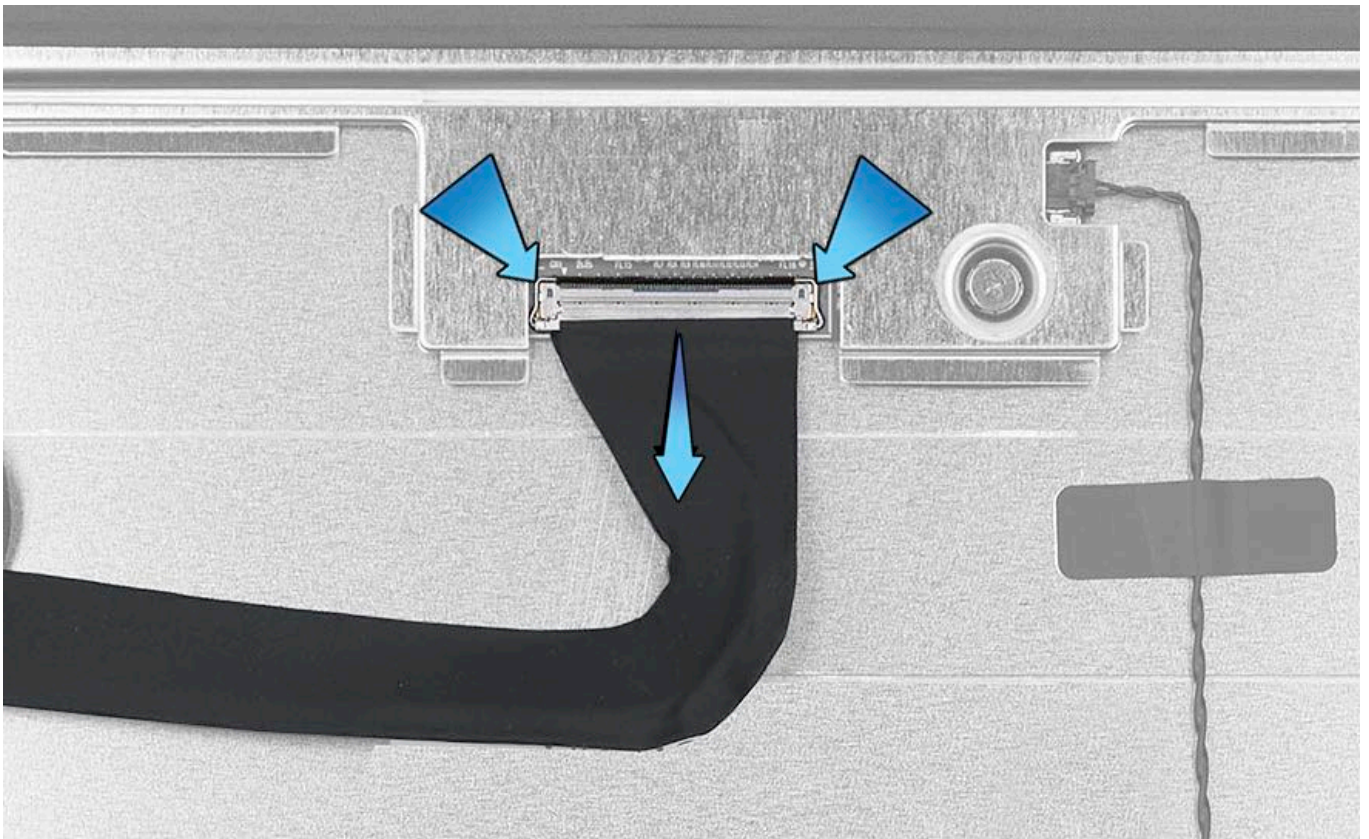
Tools

- ESD wrist strap and mat
- Black stick



Steps For Removal

1. Remove any tape that secures the Embedded DisplayPort (eDP) cable to the display panel.
2. Use a black stick to “unlock” the lock bar by gently flipping the bar toward the eDP cable.
3. Gently pull the eDP cable out of the connector.



Steps For Reassembly

1. If you are installing a new eDP cable, make sure to order the correct part number.
 - 923-00093, eDP cable: iMac (Retina 5K, 27-inch, Late 2014 and Mid 2015)
 - 923-01087, eDP cable: iMac (Retina 5K, 27-inch, Late 2015)
 - 923-01668, eDP cable: iMac (Retina 5K, 27-inch, 2017)

Note: Remove the pull tab on the back of the cable to expose the adhesive before inserting the cable into the display panel connector.



2. Insert the eDP cable into its connector. Flip the lock bar up, ensuring that the cable is securely connected. Replace any tape that was covering the cable.

Important: Press down around the lock bar to lock the lever into place.

Note: Press on the area of the cable with the adhesive, to secure the cable to the display panel.

3. Install new [display panel VHB strips](#).

4. Reinstall the [display panel](#).

Display Thermal Sensor Cable

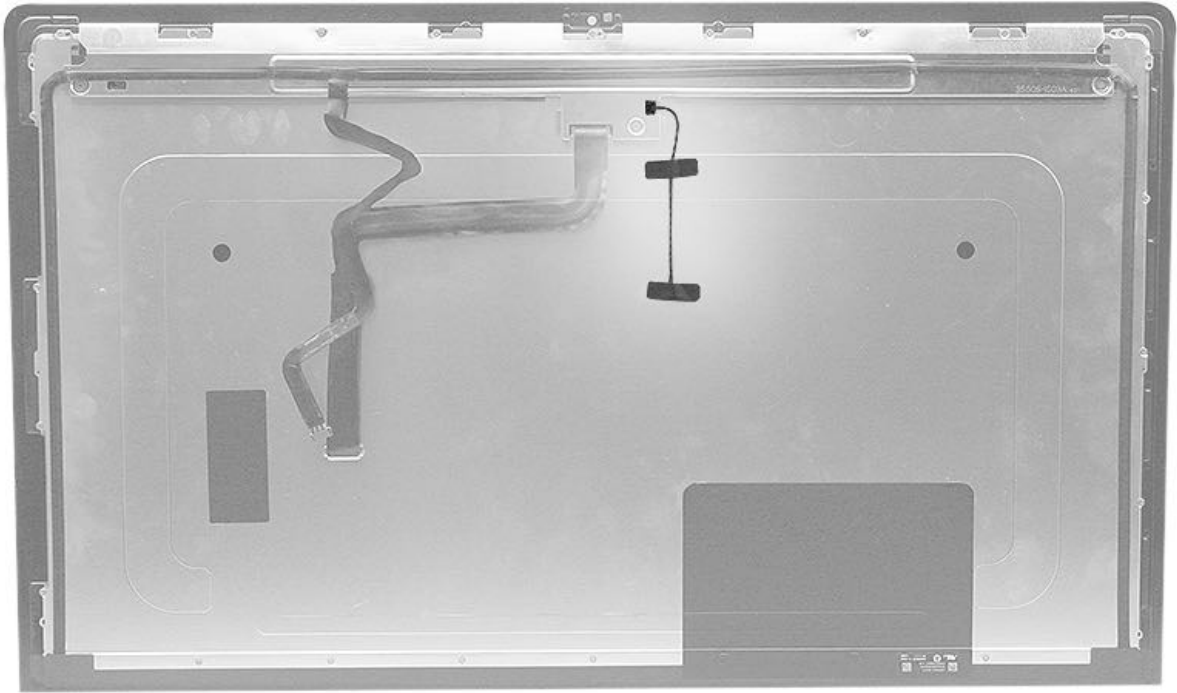
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

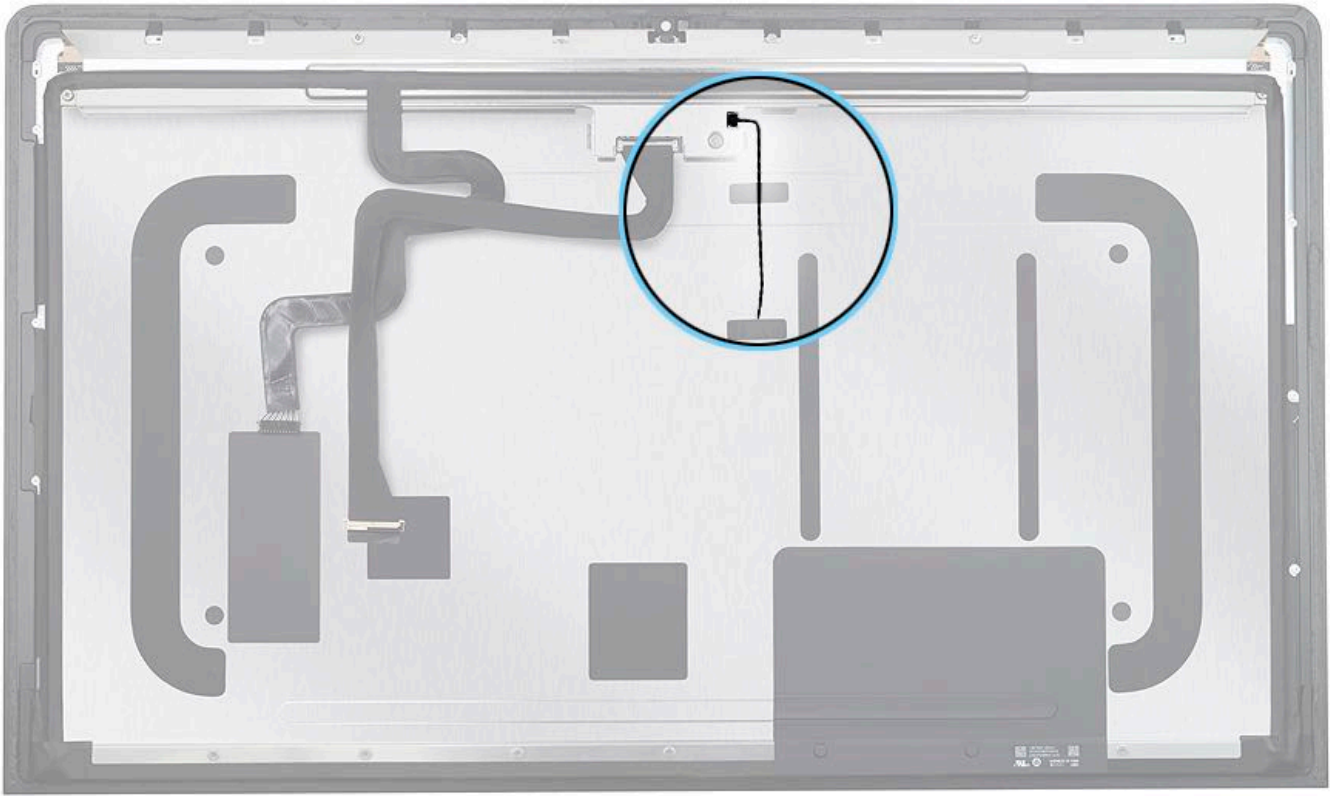
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

iMac (27-inch, Late 2012 and Late 2013)

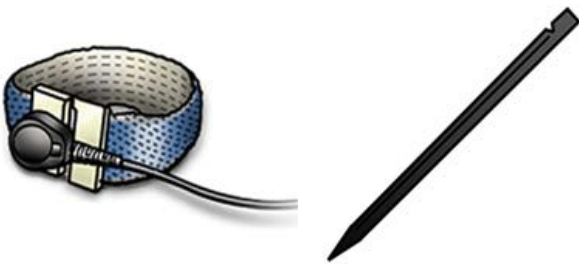


iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



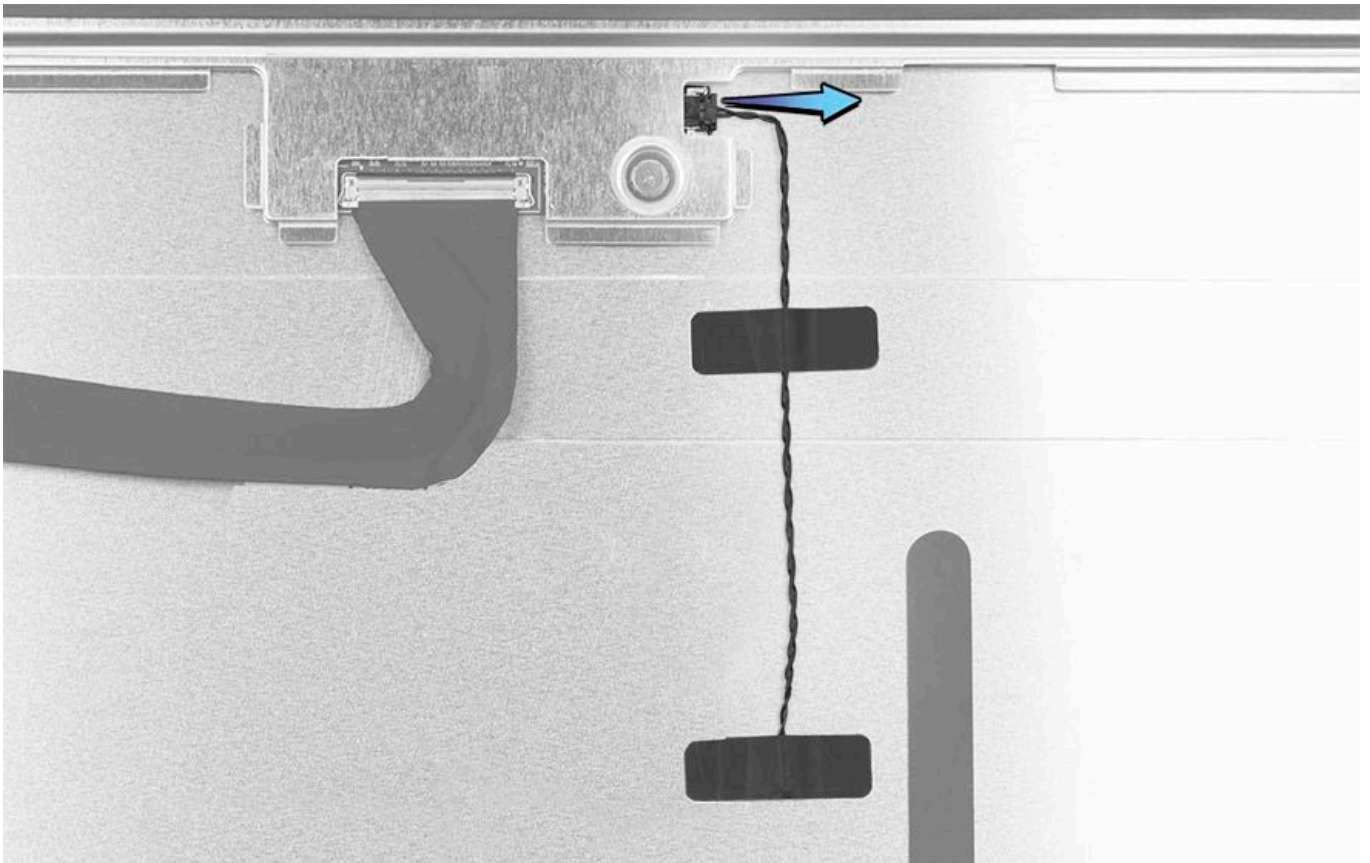
Tools

- ESD wrist strap and mat
- Black stick



Steps For Removal

1. Remove any tape that secures the display thermal sensor cable to the display panel.
2. Use the pointed end of a black stick to gently push the display thermal sensor cable out of its connector.
3. Remove the two pieces of tape that secure the thermal sensor cable to the display panel. Use a black stick to pry the square sensor board (located under the lower piece of tape) off of the display panel.



Steps For Reassembly

1. If you are installing a replacement thermal sensor cable, then peel the backing off of the sensor board and stick the sensor to the back of the display panel. If you are reinstalling the original thermal sensor cable, then press the sensor board onto the back of the display panel.
2. Insert the cable into its connector.
3. Secure the cable with tape.
4. Install new [display panel VHB strips](#).
5. Reinstall the [display panel](#).

Fan

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

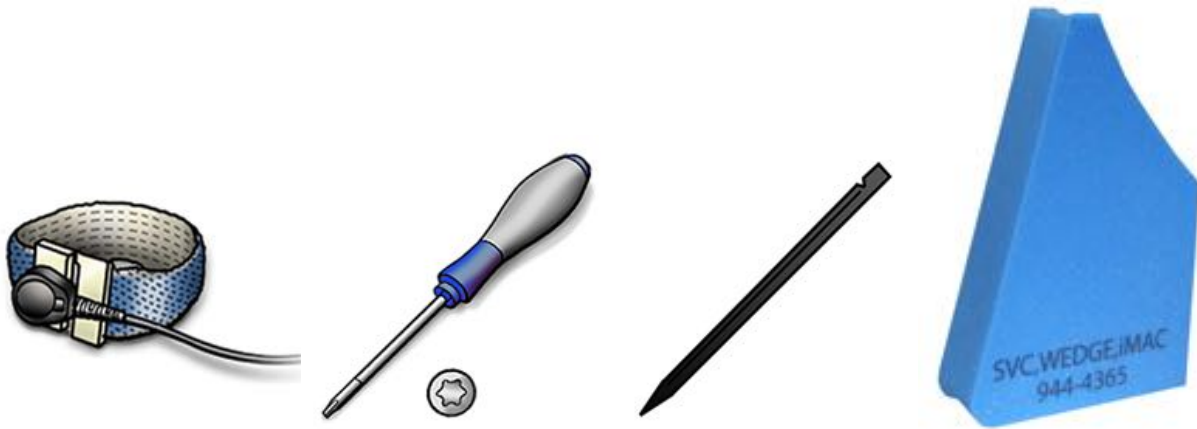
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



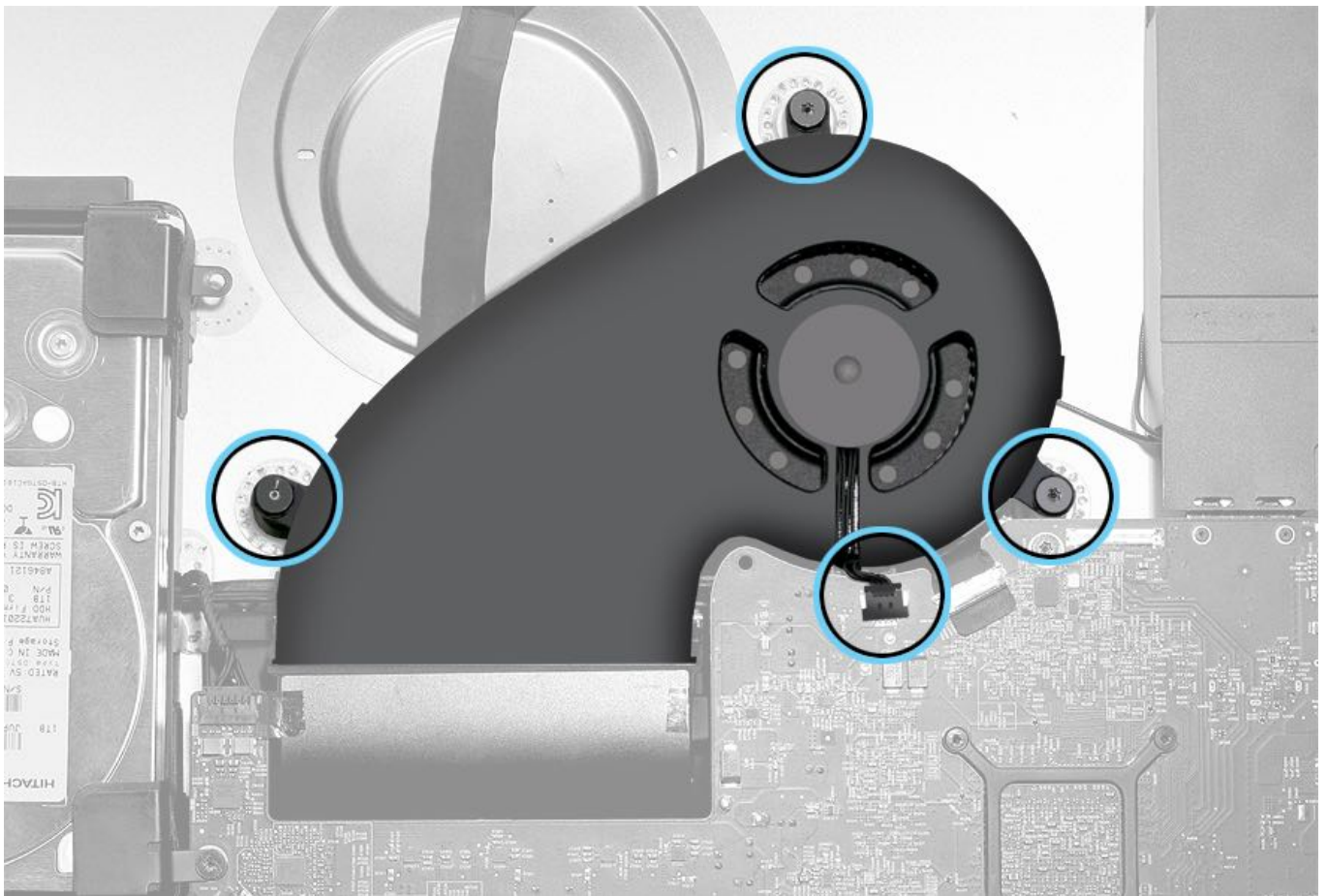
Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)

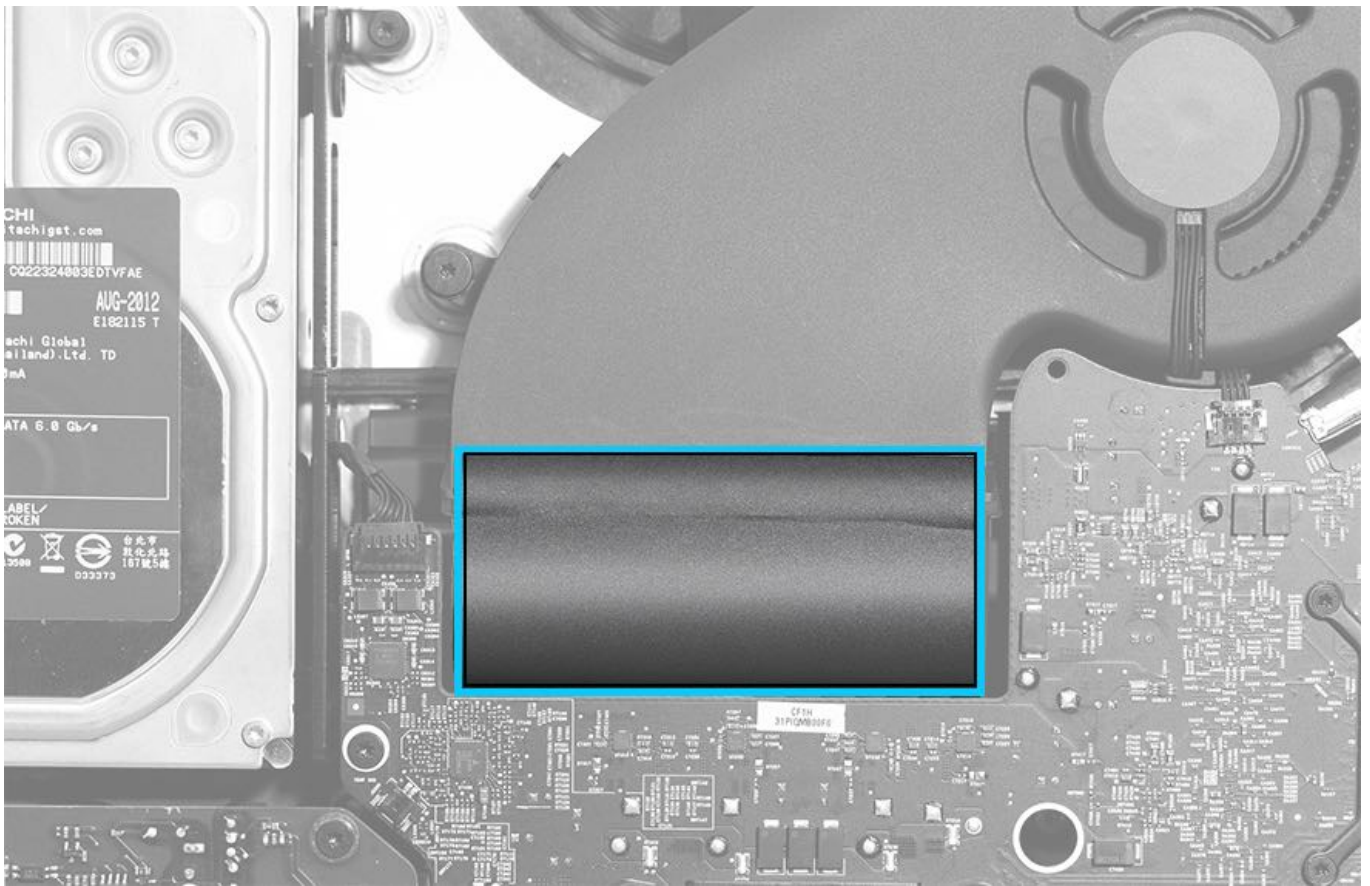


Steps For Removal

1. Use a black stick to disconnect the fan cable from the logic board.
2. Remove three T10 screws from the fan.
 - T10: 923-00669, 12.3 mm, three



3. Peel back the top edge of the black Mylar shield to loosen it from the fan. **Note:** The Mylar shield varies between models.
 - If you will be reinstalling the original fan, keep the black Mylar shield attached.
 - If you will be installing a replacement fan, transfer the black Mylar shield to the new fan.

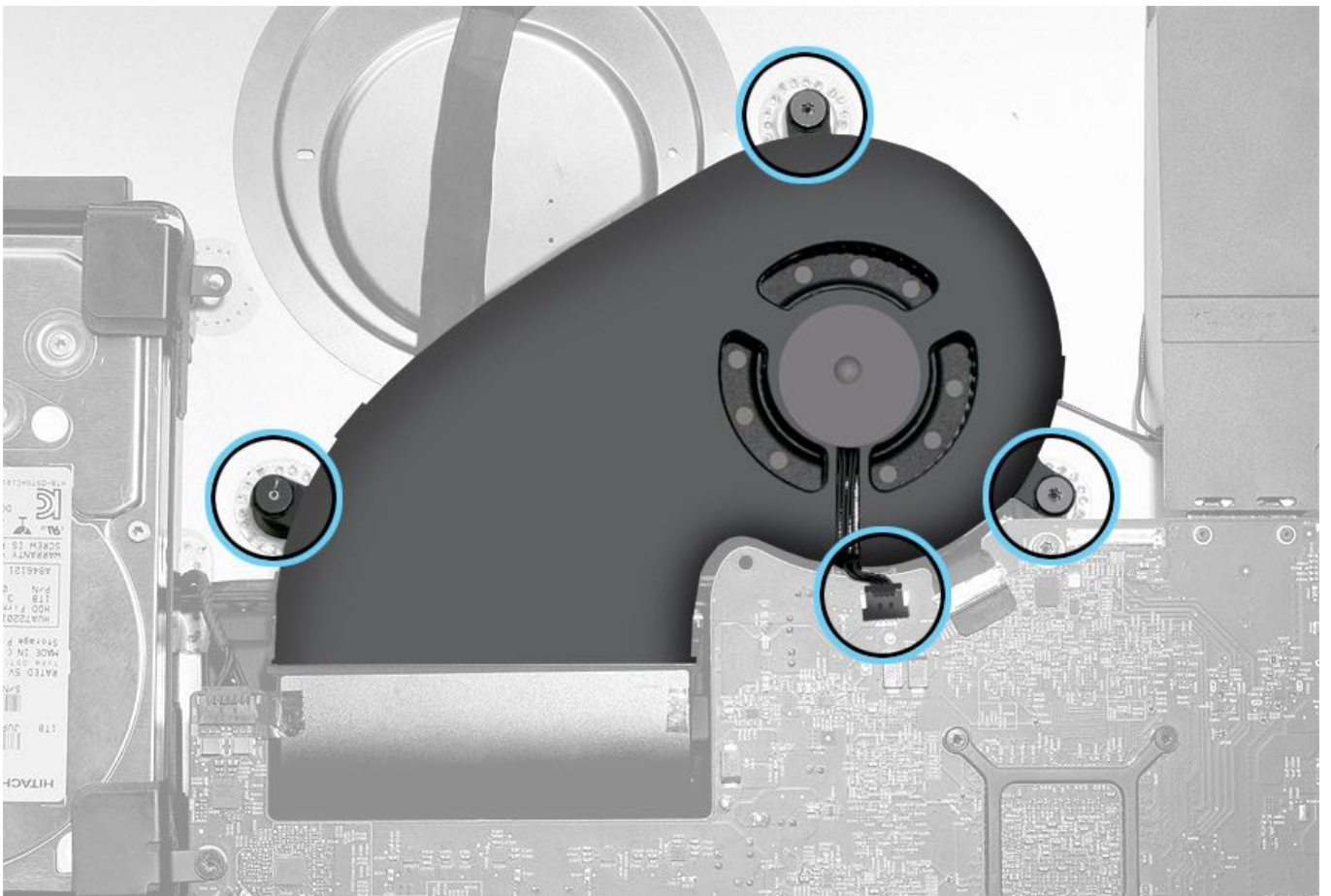


4. Remove the fan from the rear housing.

Steps For Reassembly

1. Check that the fan cable routes through the hooks on the side of the fan.
2. Connect the fan cable to the logic board.
3. Install three T10 screws to the fan.
 - T10: 923-00669, 12.3 mm, three





4. Install new [display panel VHB strips](#).

5. Reinstall the [display panel](#).

Camera

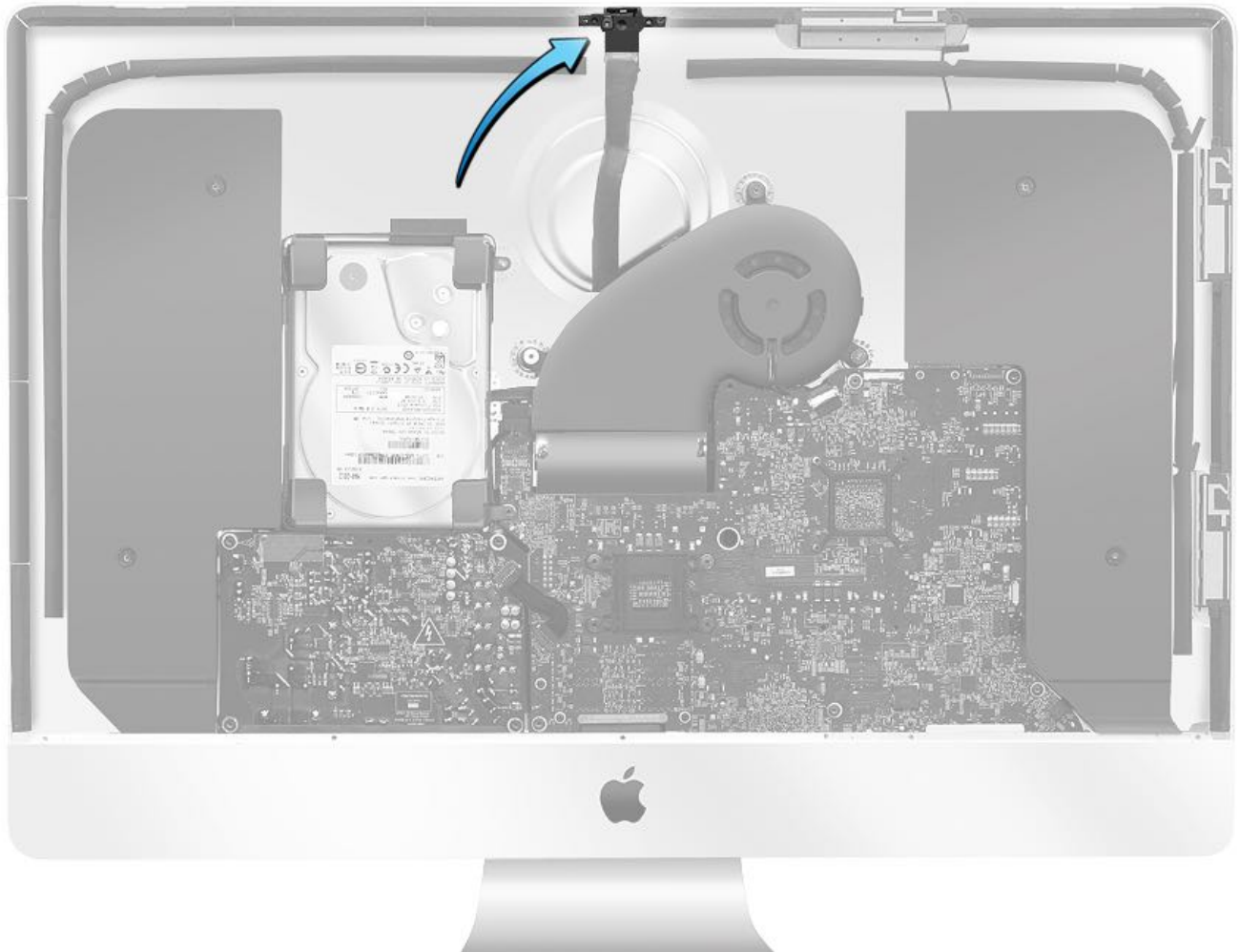
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV242: Camera Replacement Video](#).

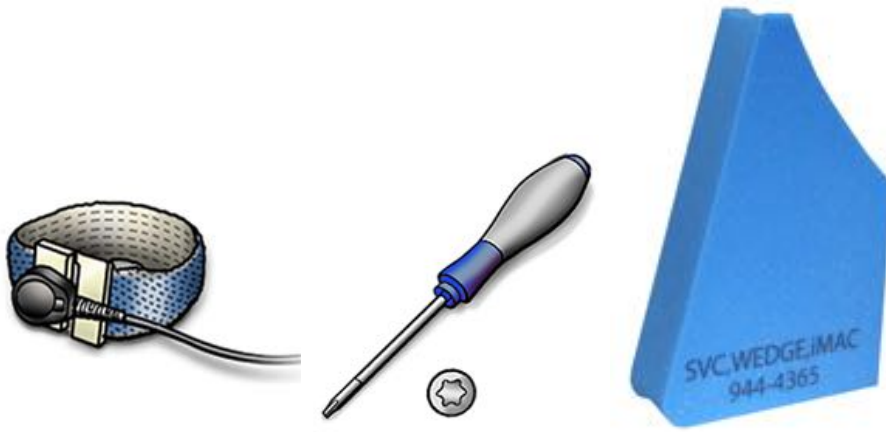
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



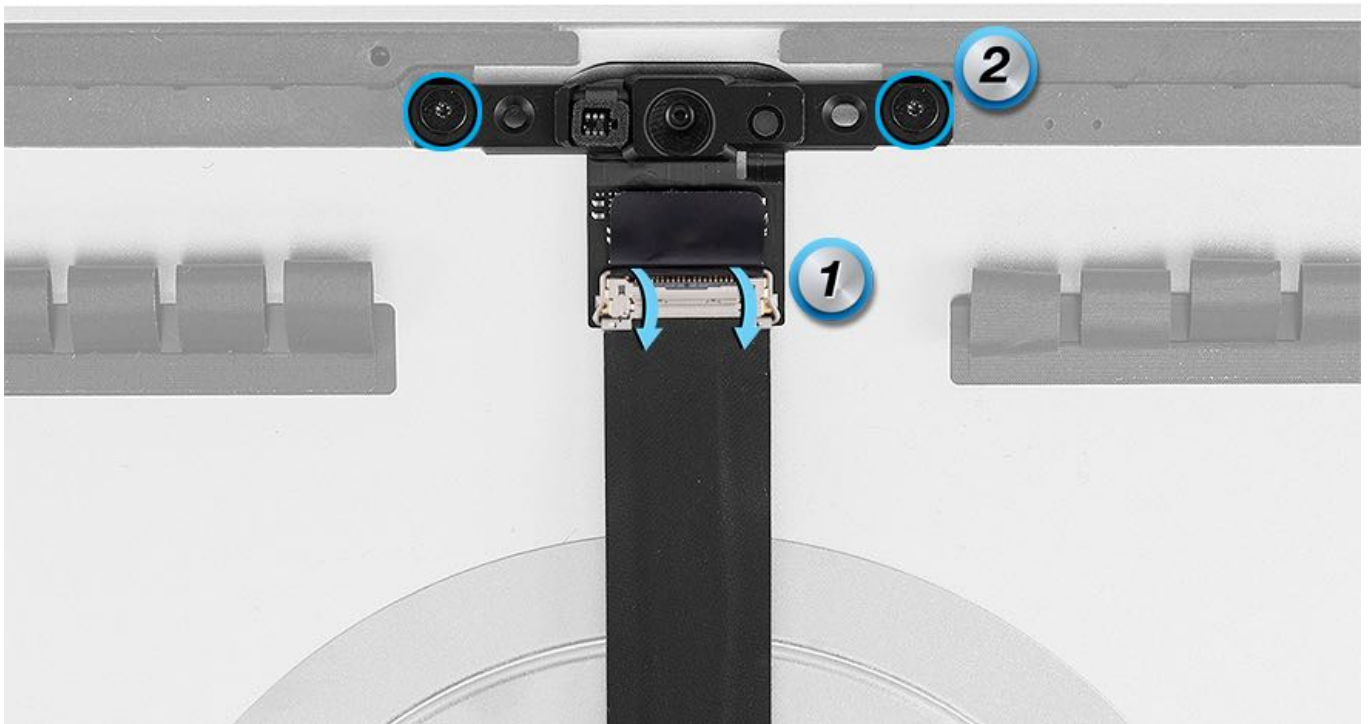
Tools

- ESD wrist strap and mat
- Torx T5 screwdriver (magnetized)
- Service wedge (iMac)



Steps For Removal

1. Use a black stick to unlock the lock bar (#1) by gently flipping the bar over toward the cable. Gently pull the cable, not the lock bar, to disconnect the cable.
2. Remove two T5 screws (#2) from the camera.
 - T5: 923-0339, 3.96 mm, two



Steps For Reassembly

1. Install two T5 screws on the camera.
 - T5: 923-0339, 3.96 mm, two



Note: If installing a replacement camera, do not forget to remove the protective film covering the lens.

2. Carefully insert the camera cable into the connector. Check that the cable is firmly inserted into the connector.
3. Flip the lock bar up to the closed position.

Important: Press around the edges of the lock bar to secure the camera cable.

4. Install new [display panel VHB strips](#).
5. Reinstall the [display panel](#).

Camera Cable

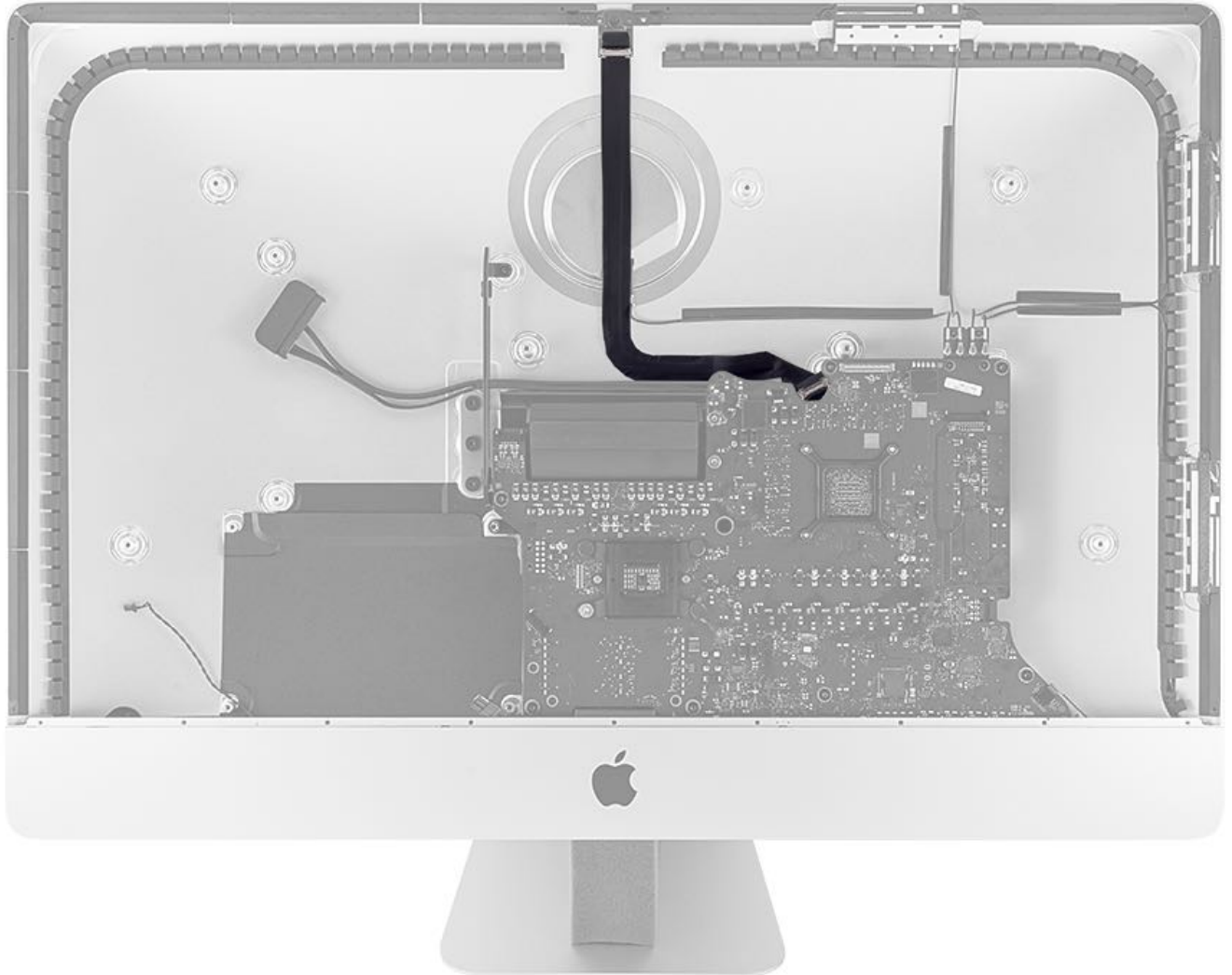
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV243: Camera/Microphone Cable Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)



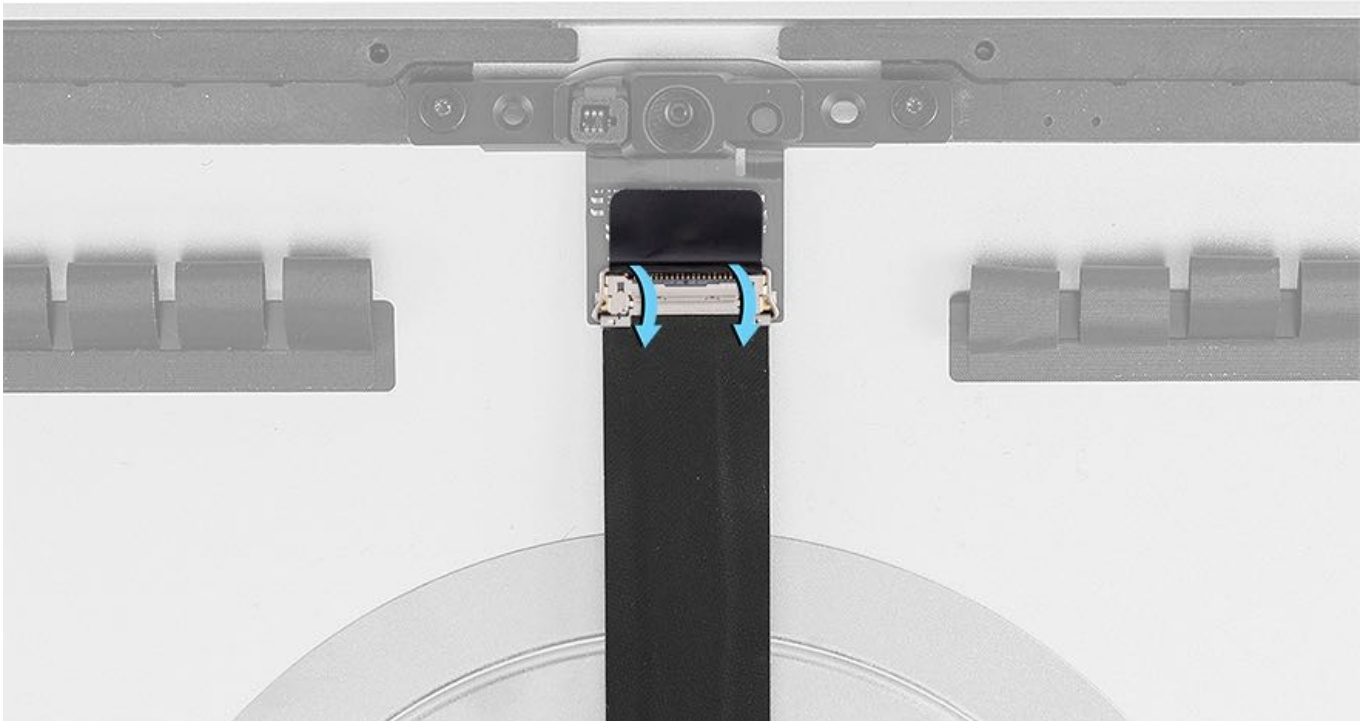
Tools

- ESD wrist strap and mat
- Black stick
- Service wedge (iMac)



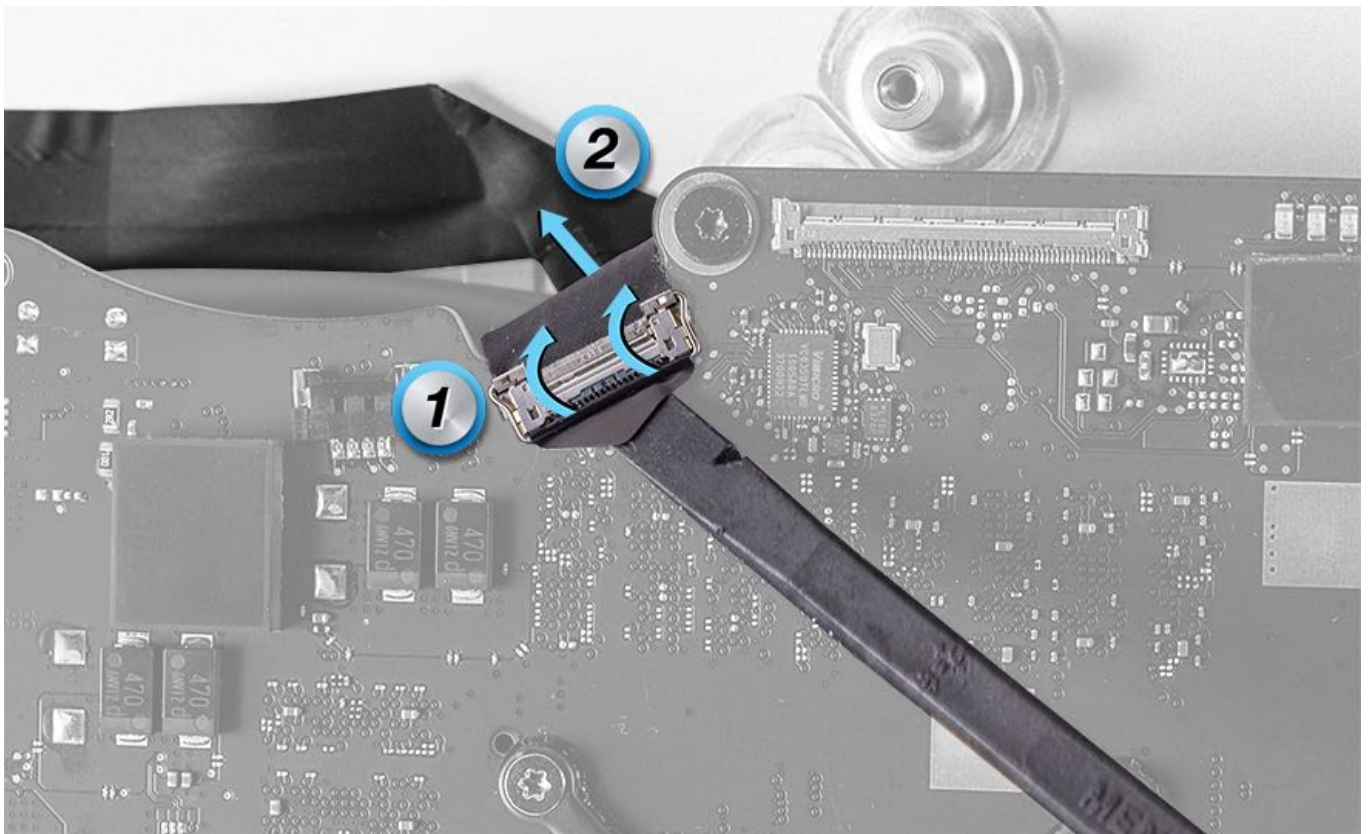
Steps For Removal

1. Use a black stick to “unlock” the lock bar on the camera by gently flipping the bar over toward the cable. Gently pull the cable, not the lock bar, to disconnect the cable.



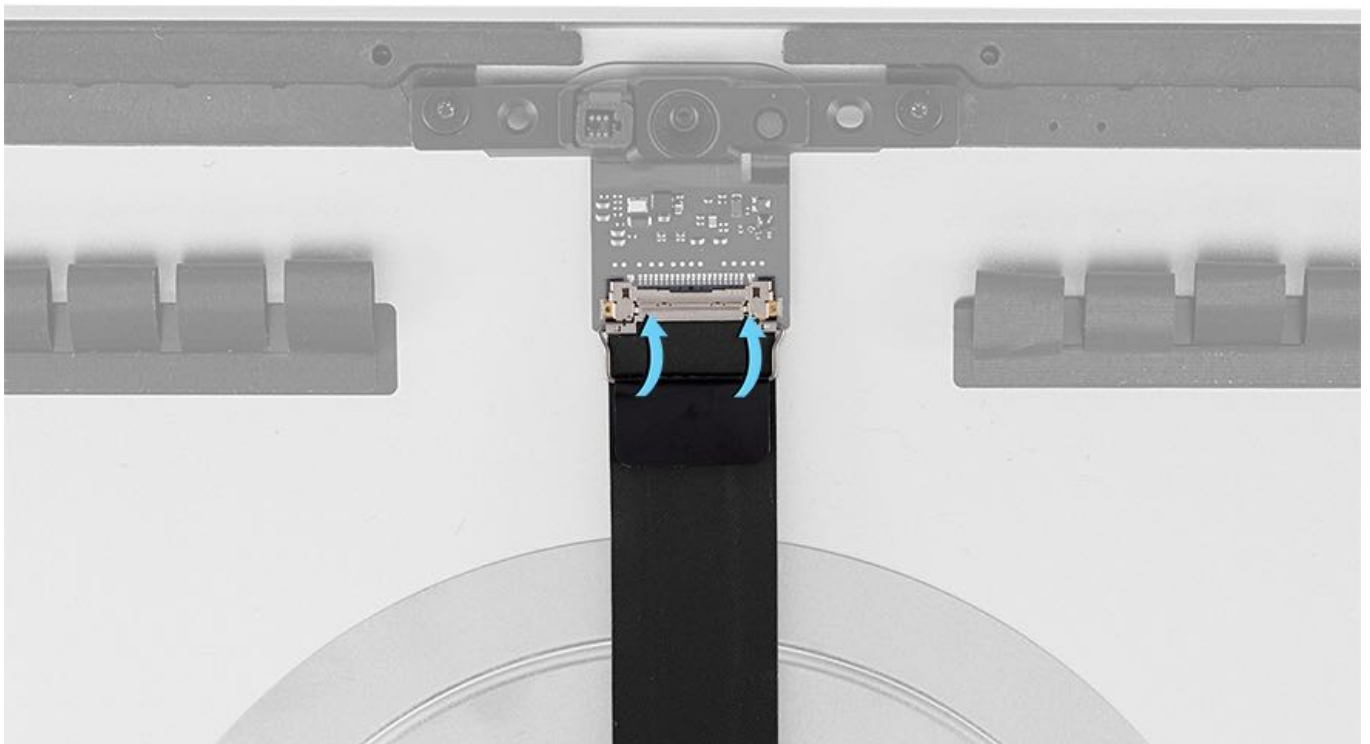
2. On the other end of the camera cable, use a black stick to “unlock” the lock bar on the logic board by flipping the lock bar (1) toward the camera cable. Gently pull the cable (2), not the lock bar, to disconnect the cable.

3. Remove the cable from the rear housing.



Steps For Reassembly

1. Position the camera cable in the rear housing.
2. Connect the camera cable to the camera board. Flip the lock bar up and check that it is secure.



3. Press along the cable to adhere it to the rear housing.
4. Insert the camera cable into the logic board connector and flip the lock bar toward the logic board. Press down around the lock bar to securely lock the cable connector in place.
5. Reinstall the [fan](#).

5. Install new [display panel VHB strips](#).
6. Reinstall the [display panel](#).

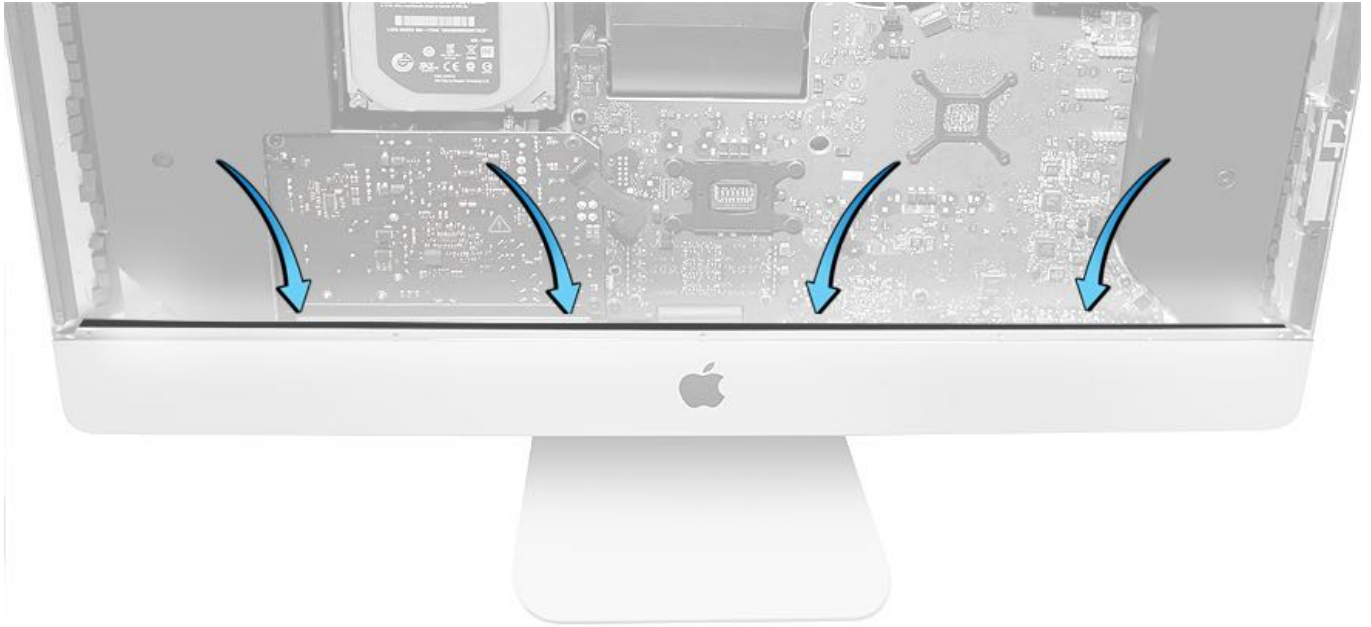
Chin Strap

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

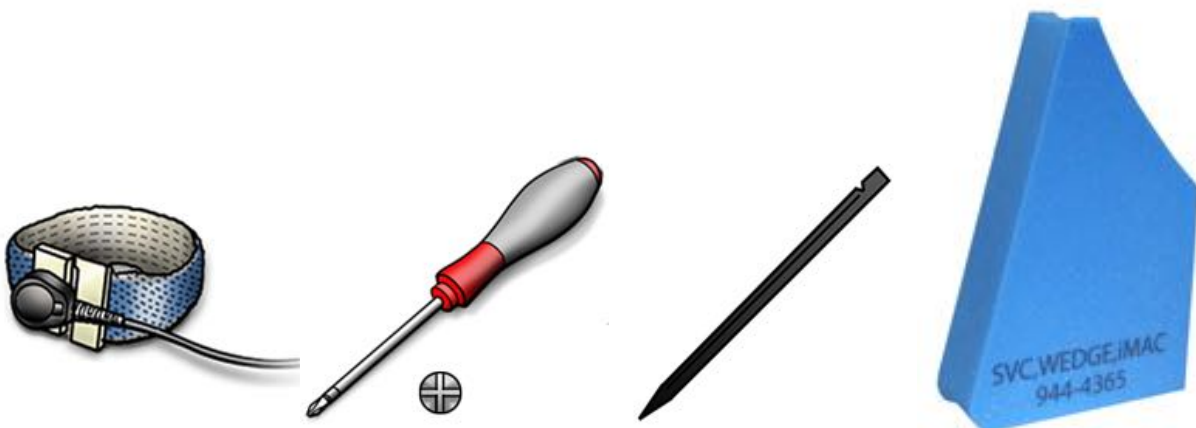
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



Tools

- ESD wrist strap and mat
- Phillips #00 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



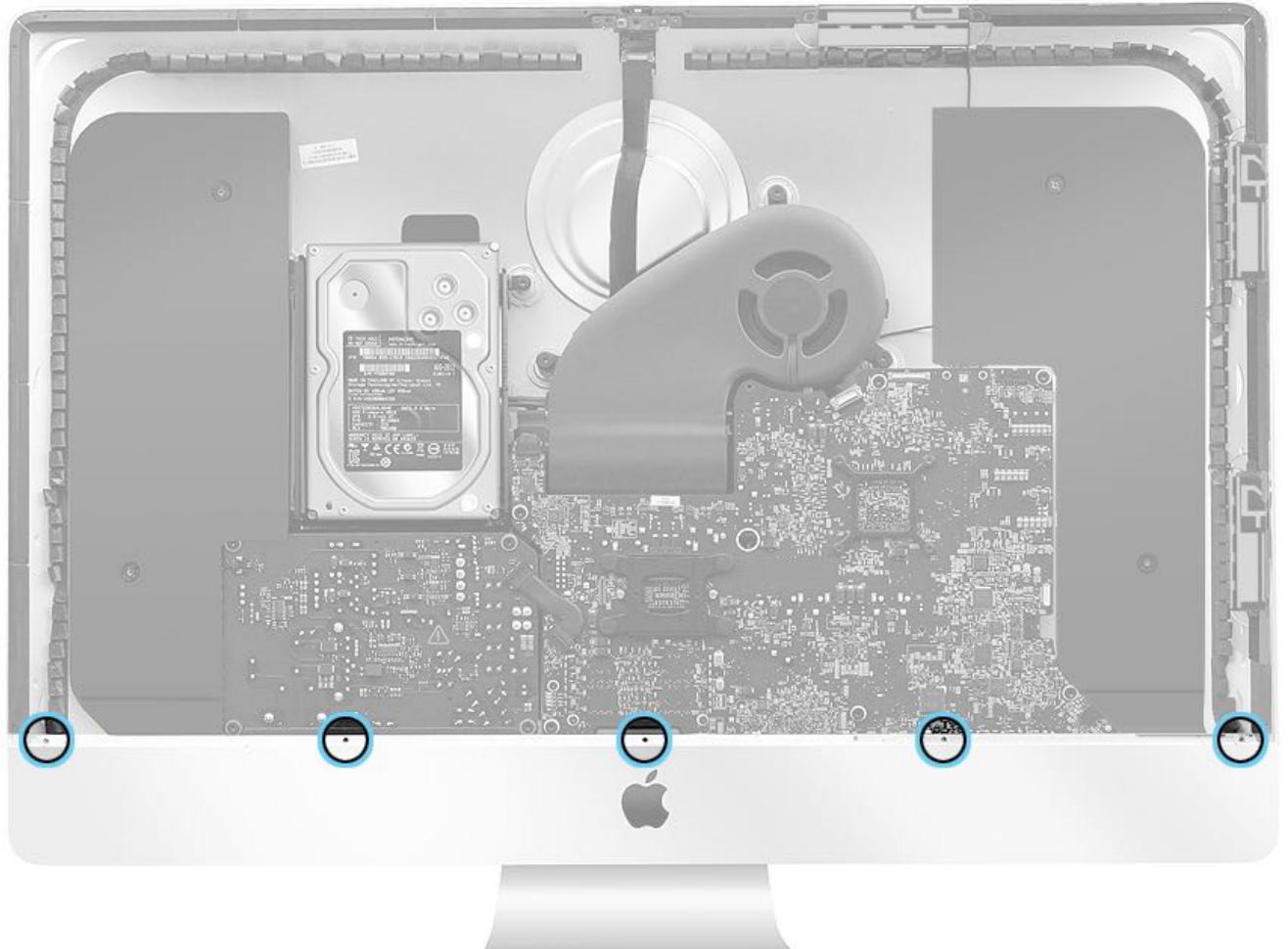
Steps For Removal

1. Depending on iMac model, remove five or nine Phillips #00 screws:

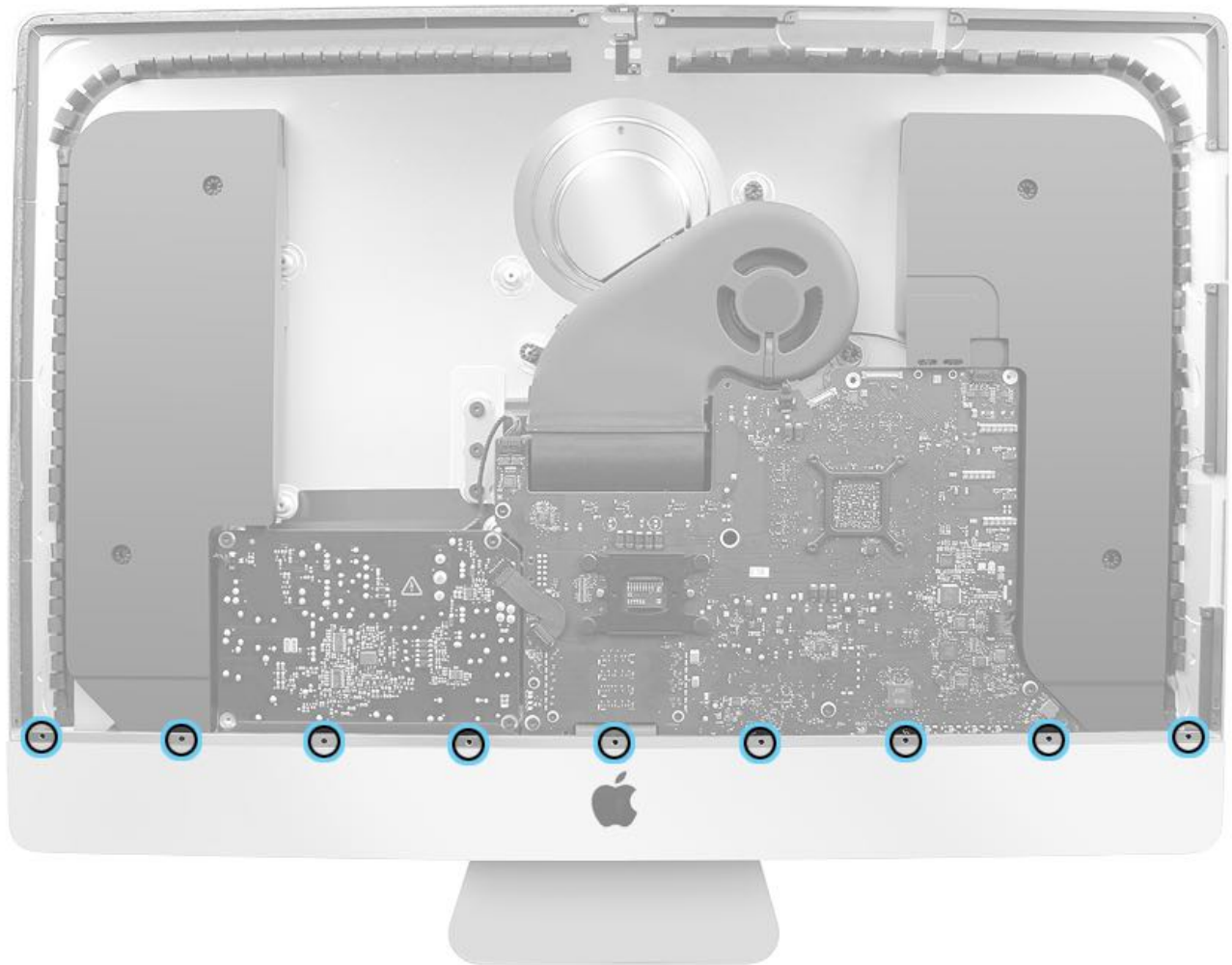
- iMac (27-inch, Late 2012):
 - Phillips #00: 923-0338, 3 mm, five
- iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017):
 - Phillips #00: 923-0338, 3 mm, nine



iMac (27-inch, Late 2012)



iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



2. Set the chin strap aside. **Caution:** Be careful not to bend the chin strap.

iMac (27-inch, Late 2012)
5-hole chin strap



iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)
9-hole chin strap



Steps For Reassembly

Important: Before ordering a replacement chin strap, check whether the system has a 5-hole chin strap or 9-hole chin strap. If the system has a 5-hole chin strap, then order the iMac (27-inch, Late 2012) chin strap kit. If the system has a 9-hole chin strap, then order the iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017) chin strap kit.

1. Insert the chin strap into the rear housing. Be sure the metal screw holes face the inside edge of the chin on the rear housing. The foam edge on the chin strap should be facing up.



2. Use a black stick to press the chin strap against the front frame, if needed. Refer to the next step for screw replacement order.

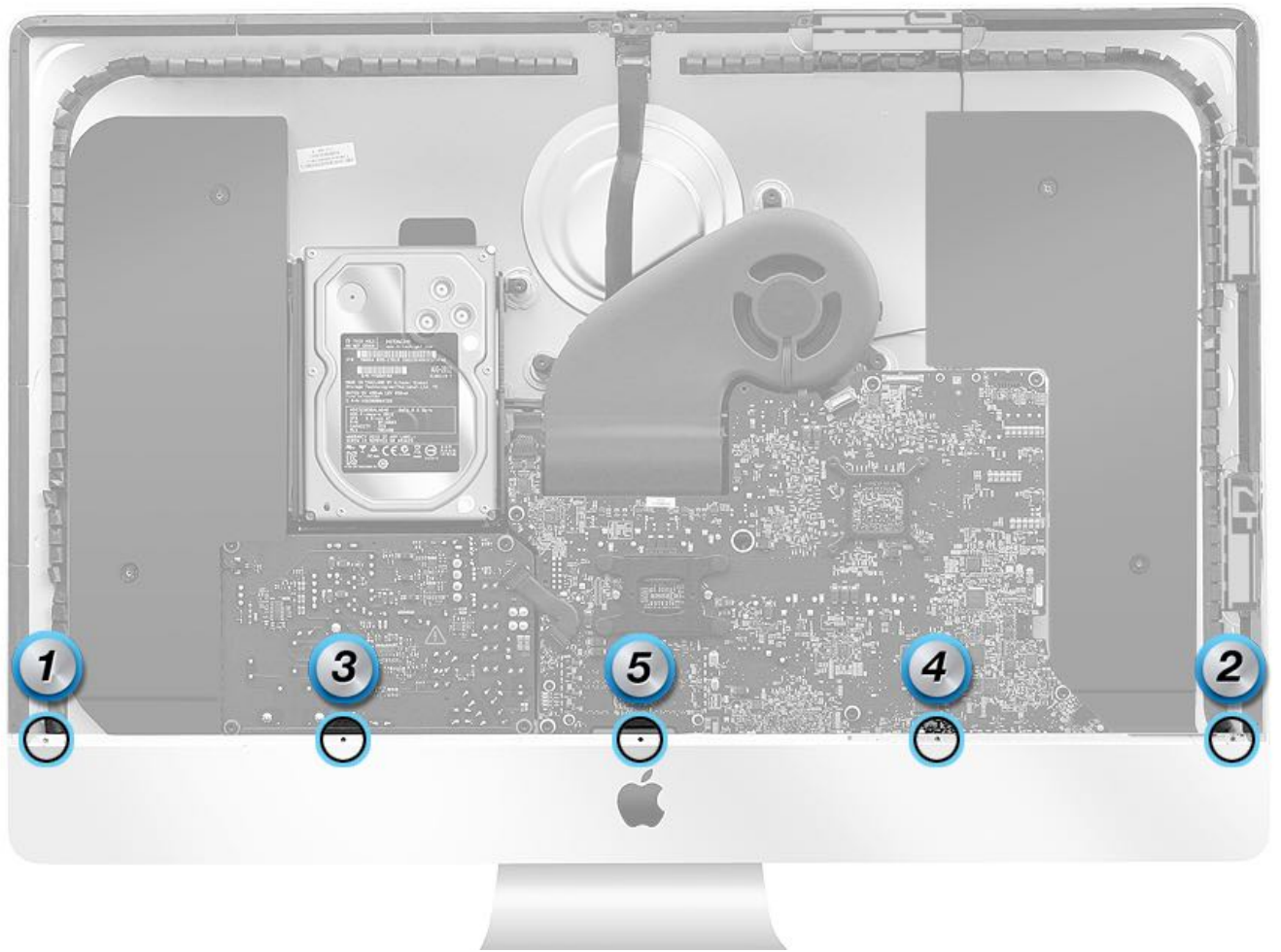


3. Install Phillips #00 screws to secure the chin strap in the following order:

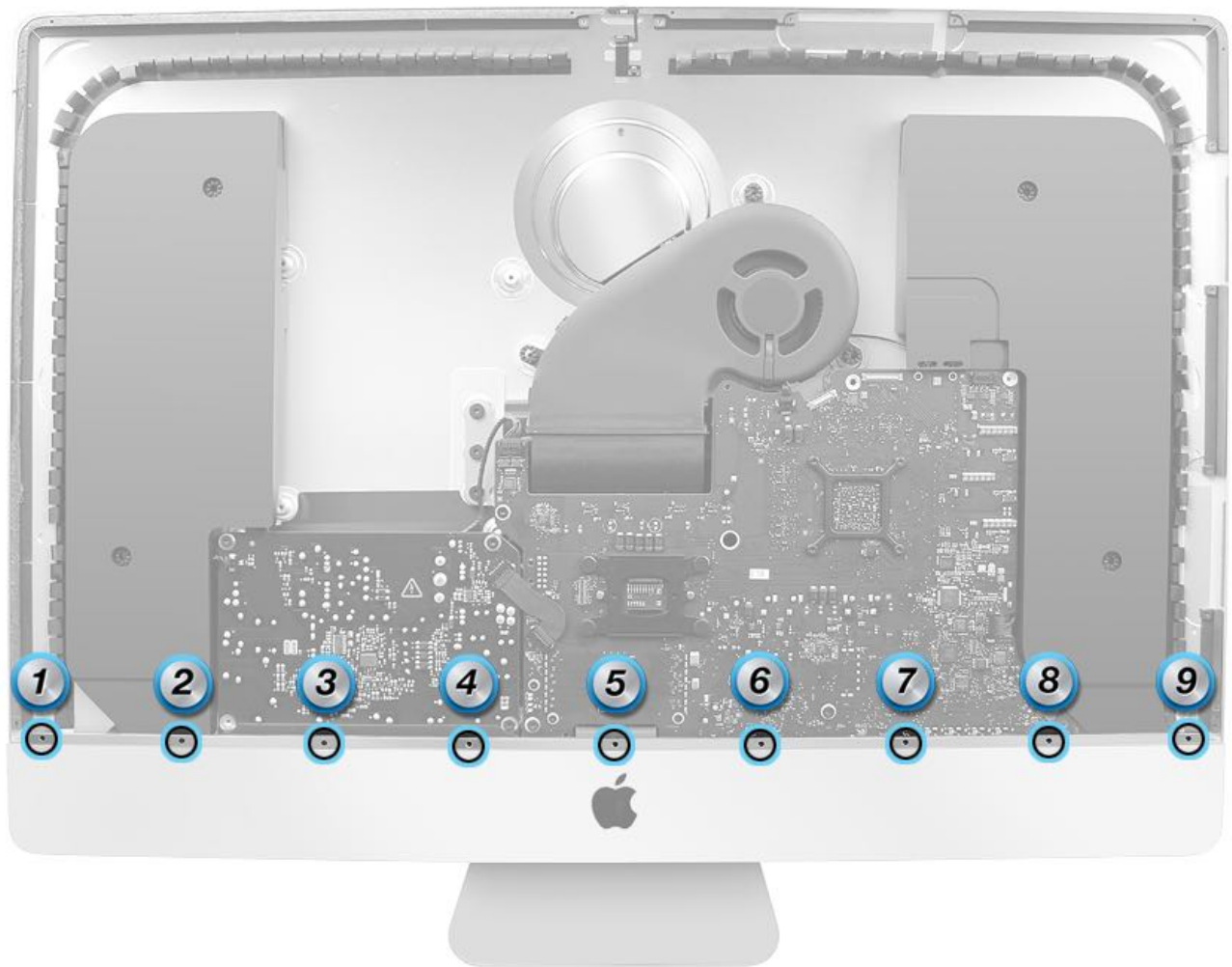
- iMac (27-inch, Late 2012):
 - Phillips #00: 923-0338, 3 mm, five
- iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017):
 - Phillips #00: 923-0338, 3 mm, nine



iMac (27-inch, Late 2012): 5-hole chin strap



iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017): 9-hole chin strap



4. Install new [display panel VHB strips](#).
5. Reinstall the [display panel](#).

Right Speaker

First Steps

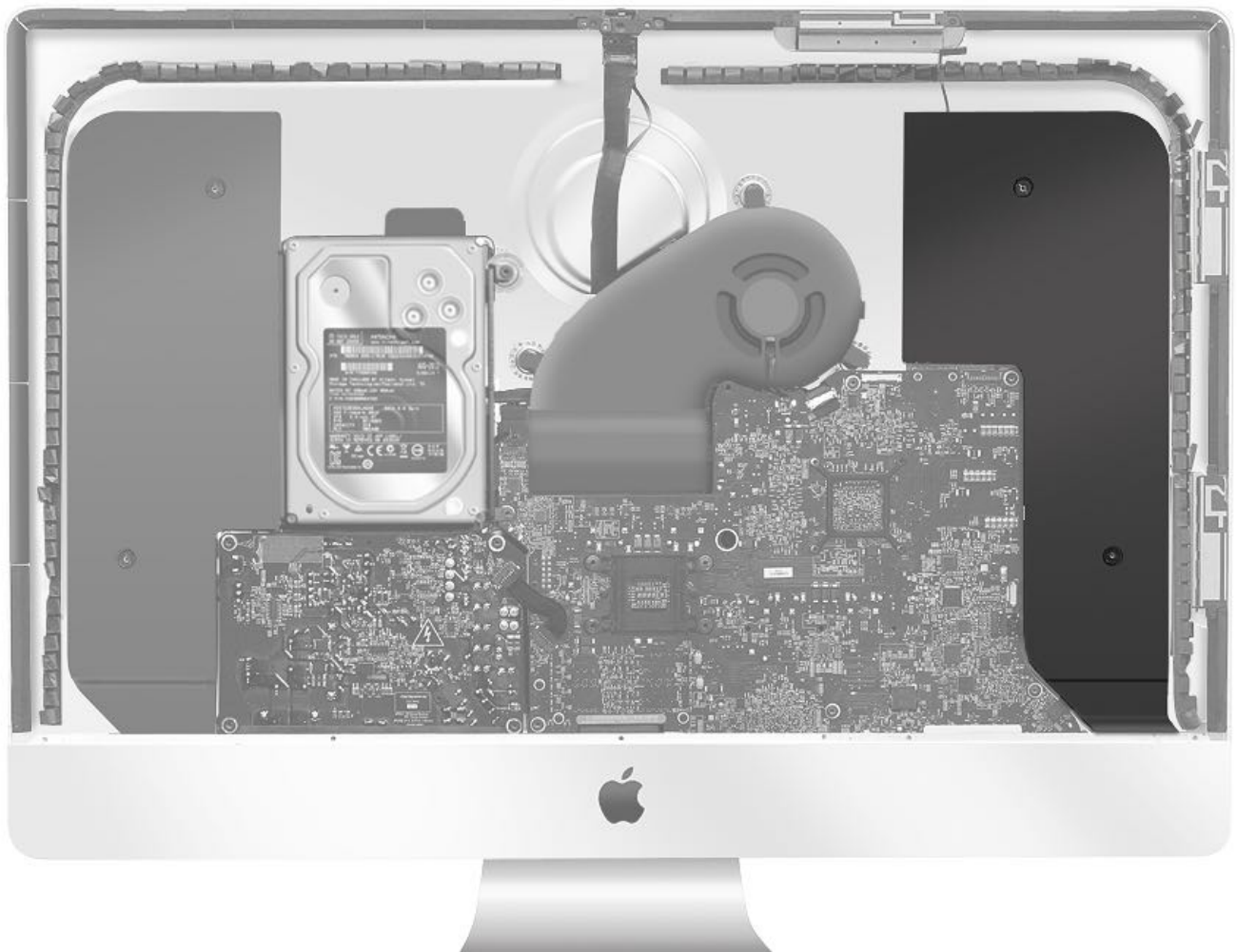
Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)

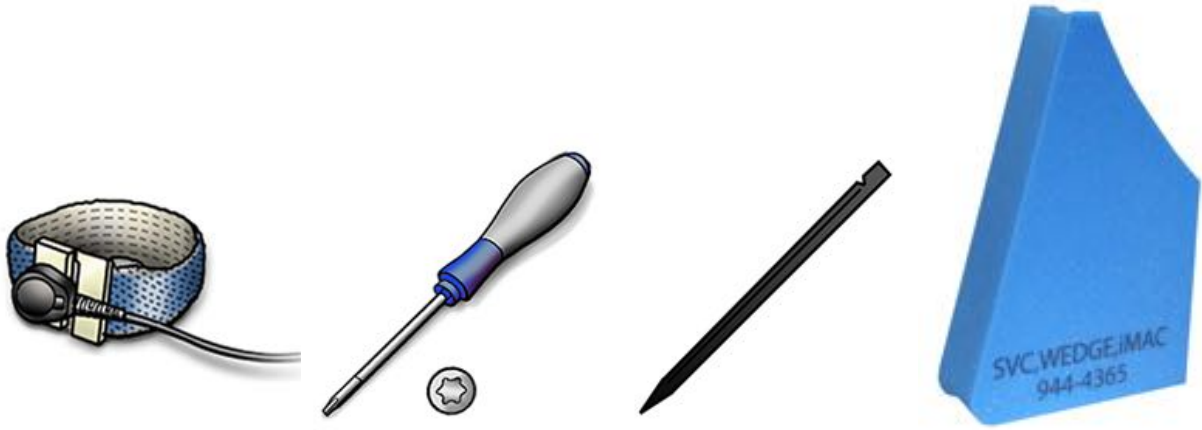
Important: Speakers must be replaced in pairs. If you replace the right speaker, then you must also replace the left speaker. For left speaker removal and reassembly instructions, refer to article [RP957: Left Speaker](#).

Note: Images of the iMac (27-inch, Late 2013) model are shown for this procedure.



Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)

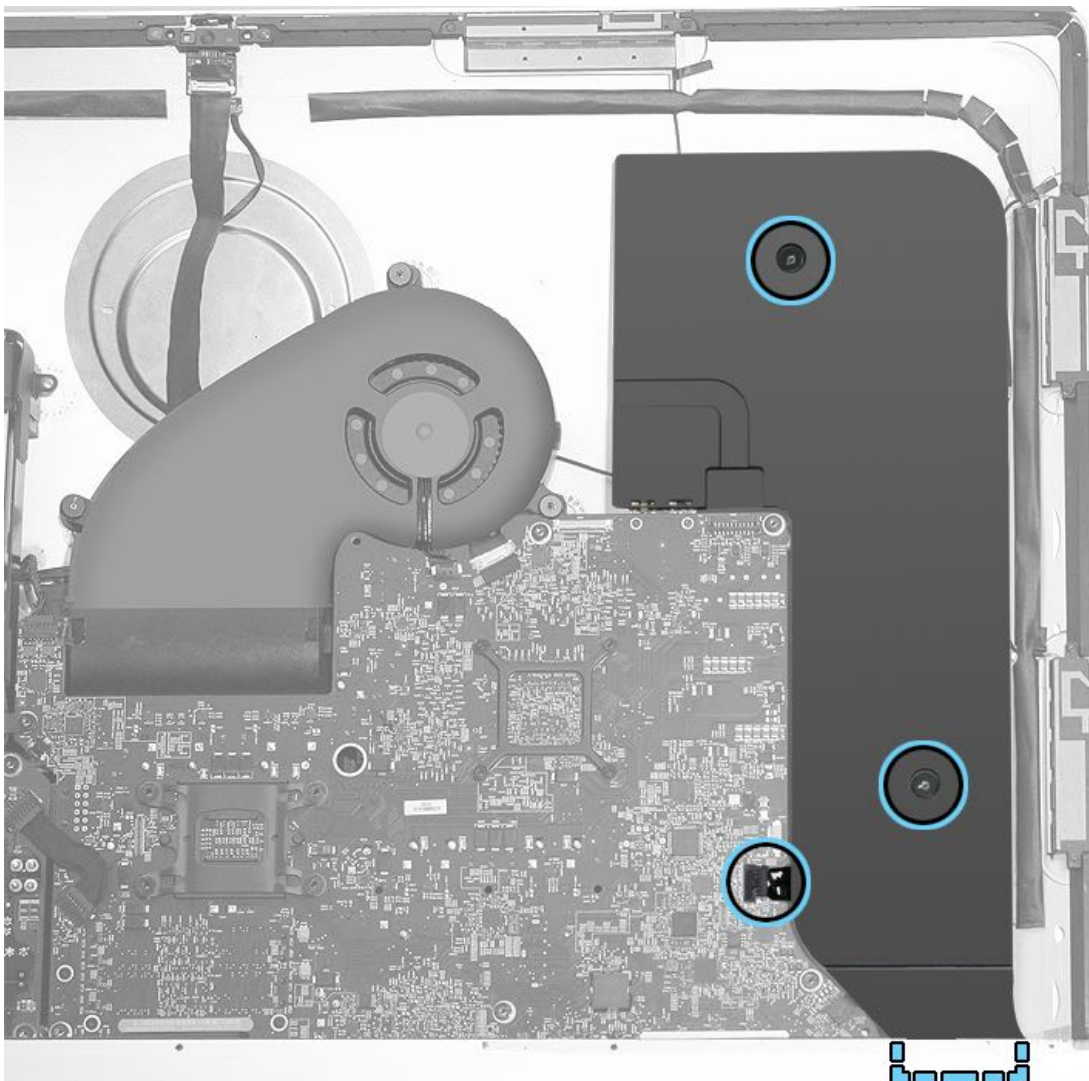


Steps For Removal

1. Completely unscrew two T10 screws and disconnect the speaker cable from logic board.

Note: The screws tighten into rubber grommets and may remain in the screw holes when the speaker is removed.

- T10: 923-0333, 10 mm



2. Pull speaker forward slightly (#1), then slide the speaker up (#2) and out of the rear housing.



Steps For Reassembly

1. Carefully insert the speaker all the way into the rear housing.

Note: Push firmly to ensure that the speaker sits down inside the rear housing as far as possible. If the speaker is not positioned correctly in the rear housing, then it can cause display interference issues.

2. Connect the speaker cable to the logic board and tuck the speaker cable under the logic board.

3. Install the two T10 speaker screws.

4. Reinstall the [chin strap](#).

5. Install new [display panel VHB strips](#).

6. Reinstall the [display panel](#).

Left Speaker

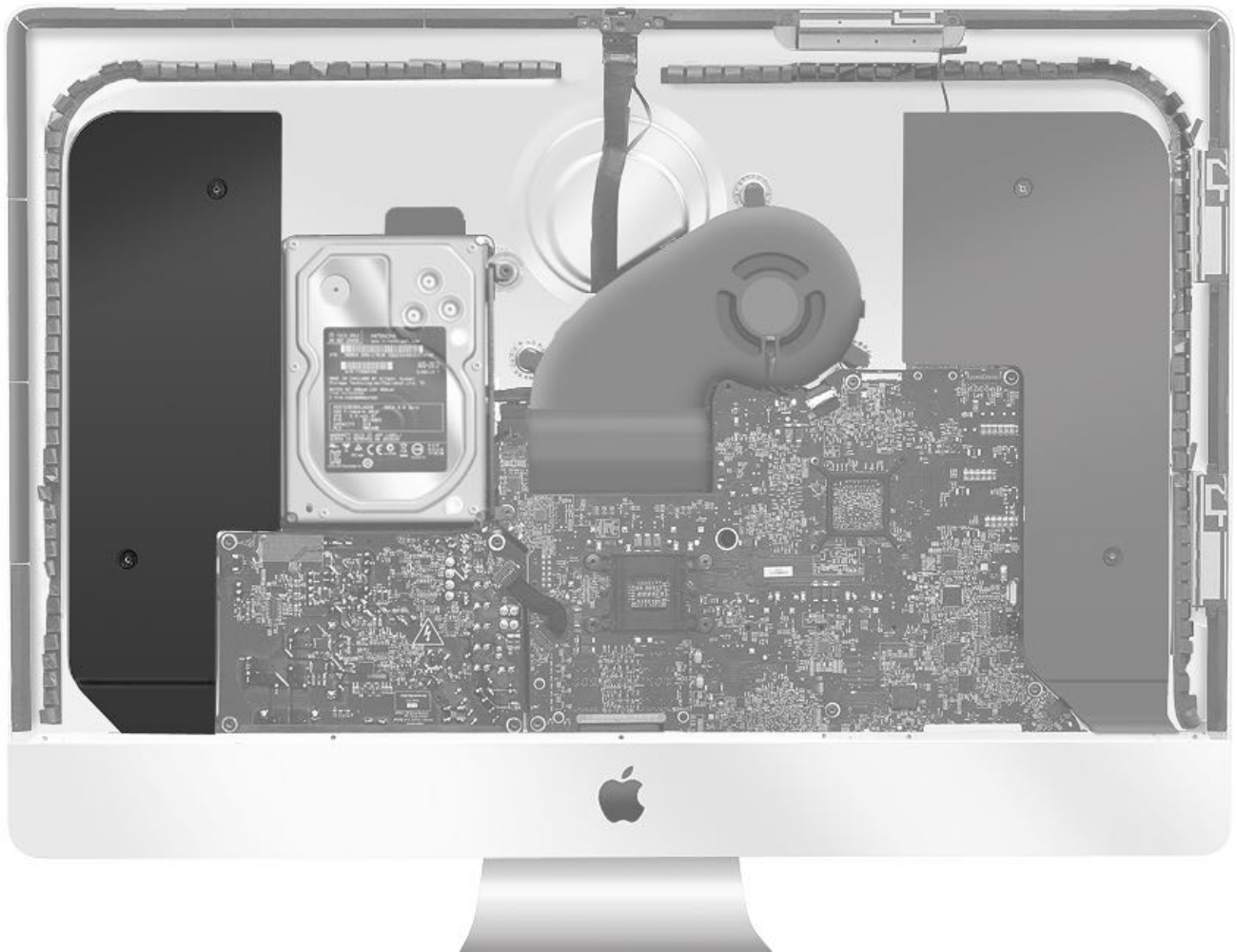
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

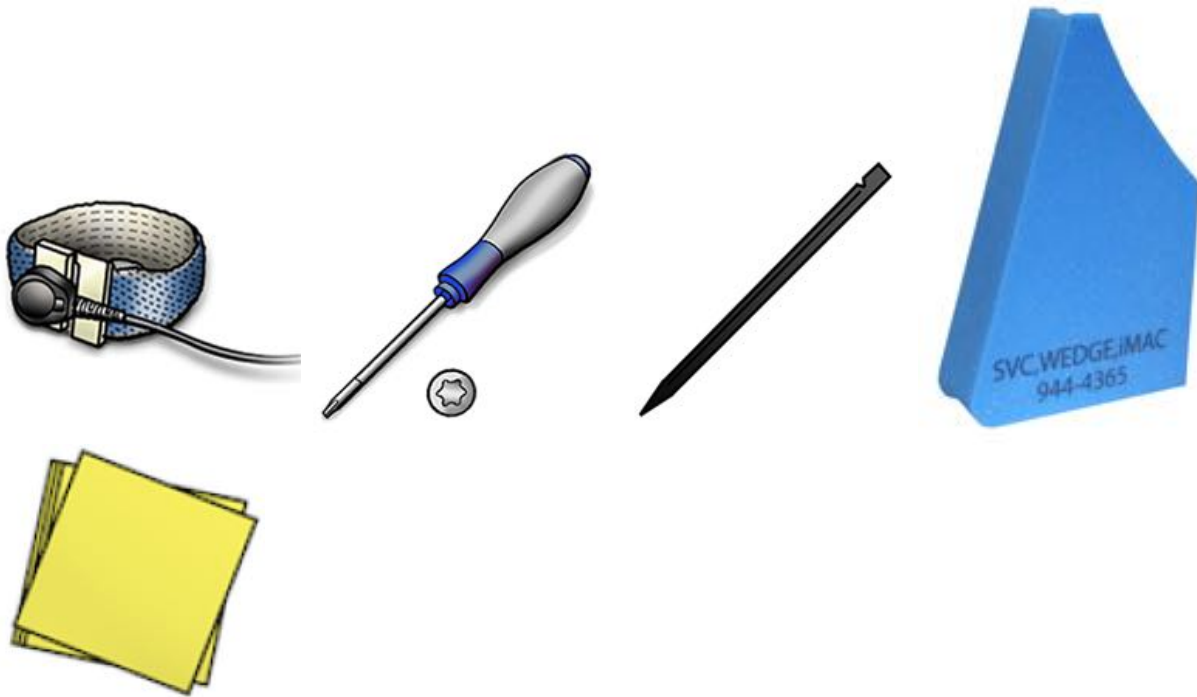
- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)

Important: Speakers must be replaced in pairs. If you replace the left speaker, then you must also replace the right speaker. For right speaker removal and reassembly instructions, refer to article [RP956: Right Speaker](#).



Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)
- Sticky notes



Steps For Removal

1. Carefully disconnect the power button cable from the power supply.

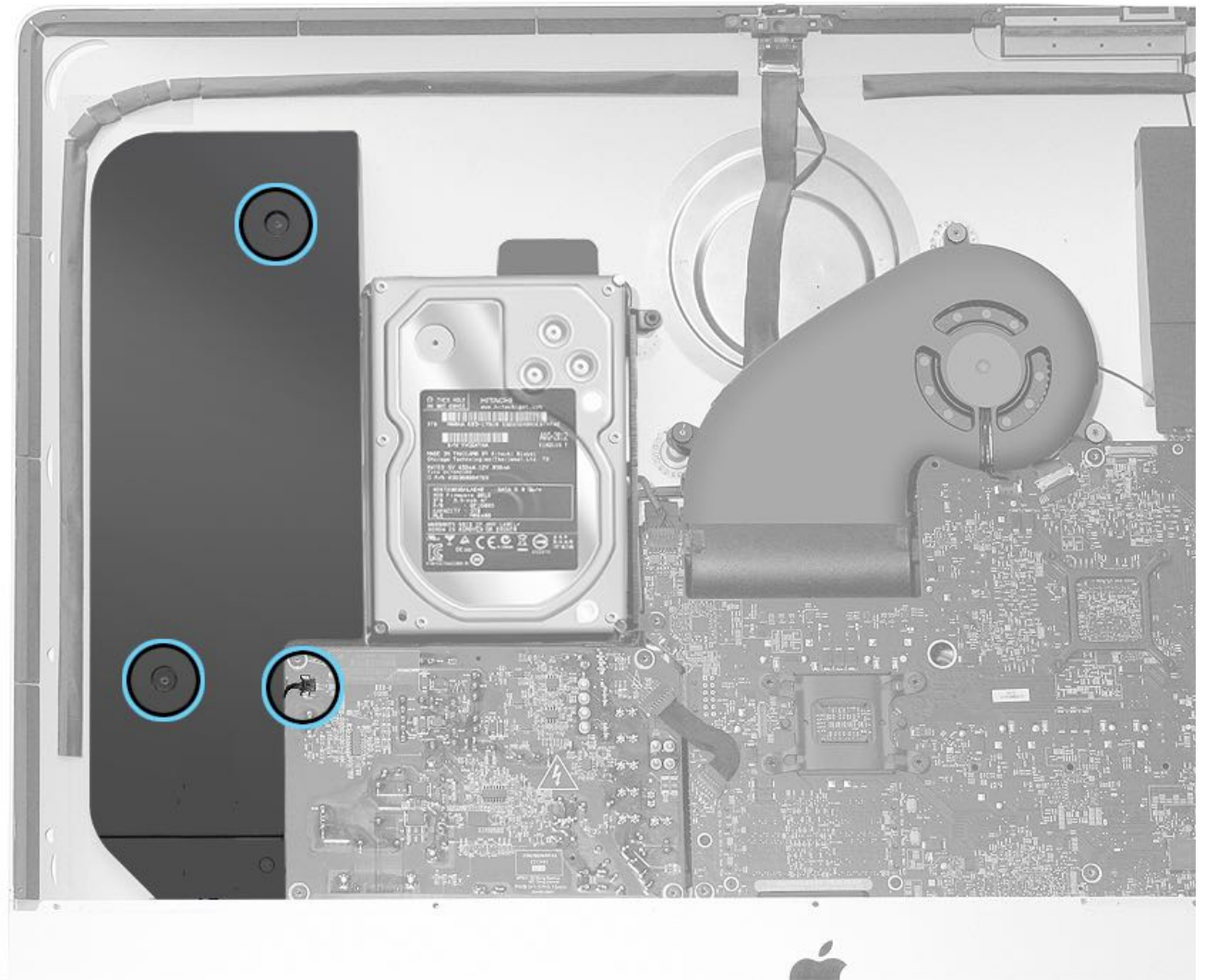
Important: If the power button cable breaks, then the rear housing will need to be replaced. The power button cable is part of the rear housing.

2. Completely unscrew two T10 screws.

Note: The screws tighten into rubber grommets and may remain in the screw holes when the speaker is removed.

- T10: 923-0333, 10 mm



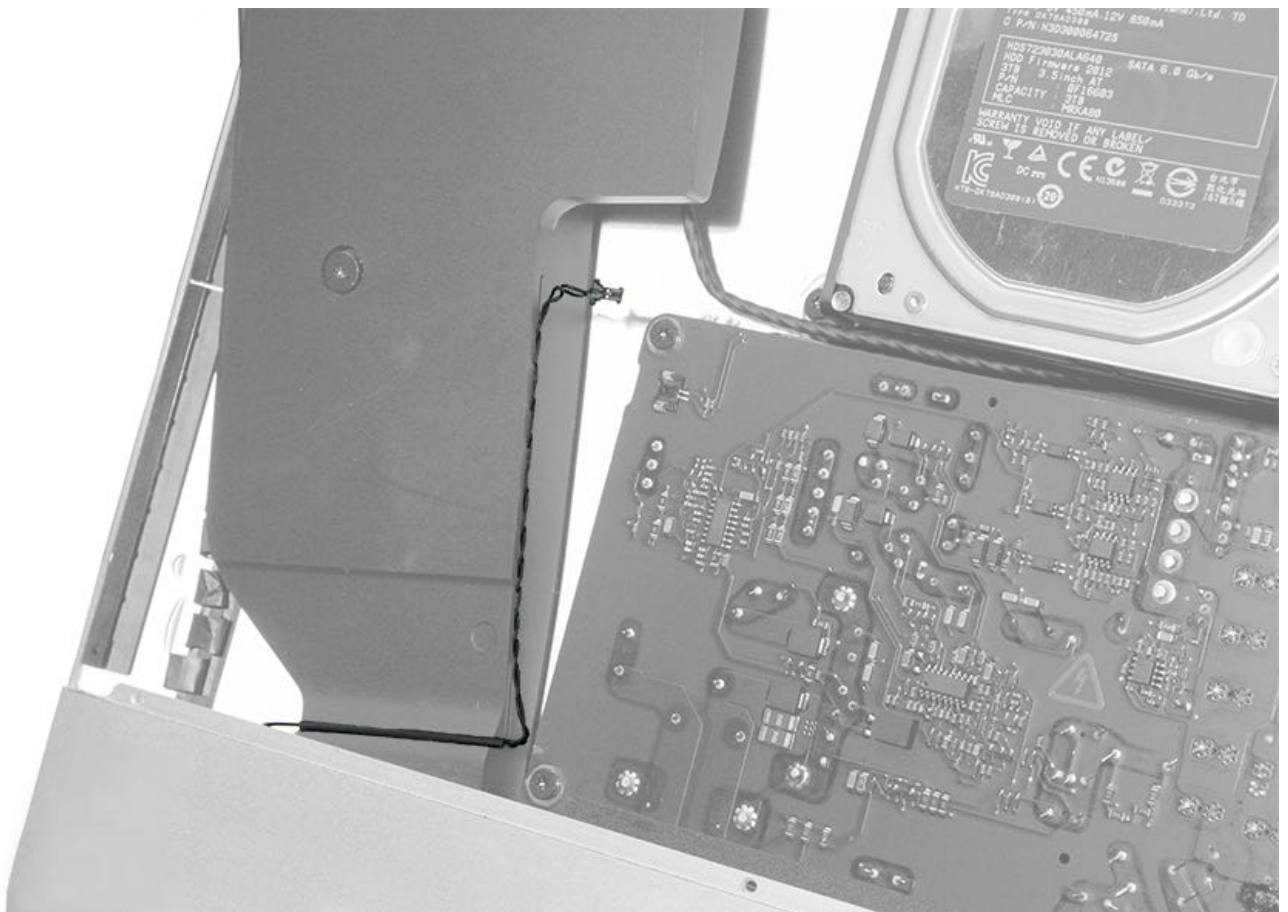


3. Pull the speaker forward, then push in on the lower end of the speaker (to clear the rear housing). Lift the speaker up and off to the side until the power button cable is visible.

Important: Be careful of the power button cable in the groove on the speaker. A broken power button cable requires a replacement rear housing.



4. **Important:** Use care when handling the speaker to avoid damaging the power button cable. Gently remove the power button cable from the routing groove on the side and the lower end of the speaker.



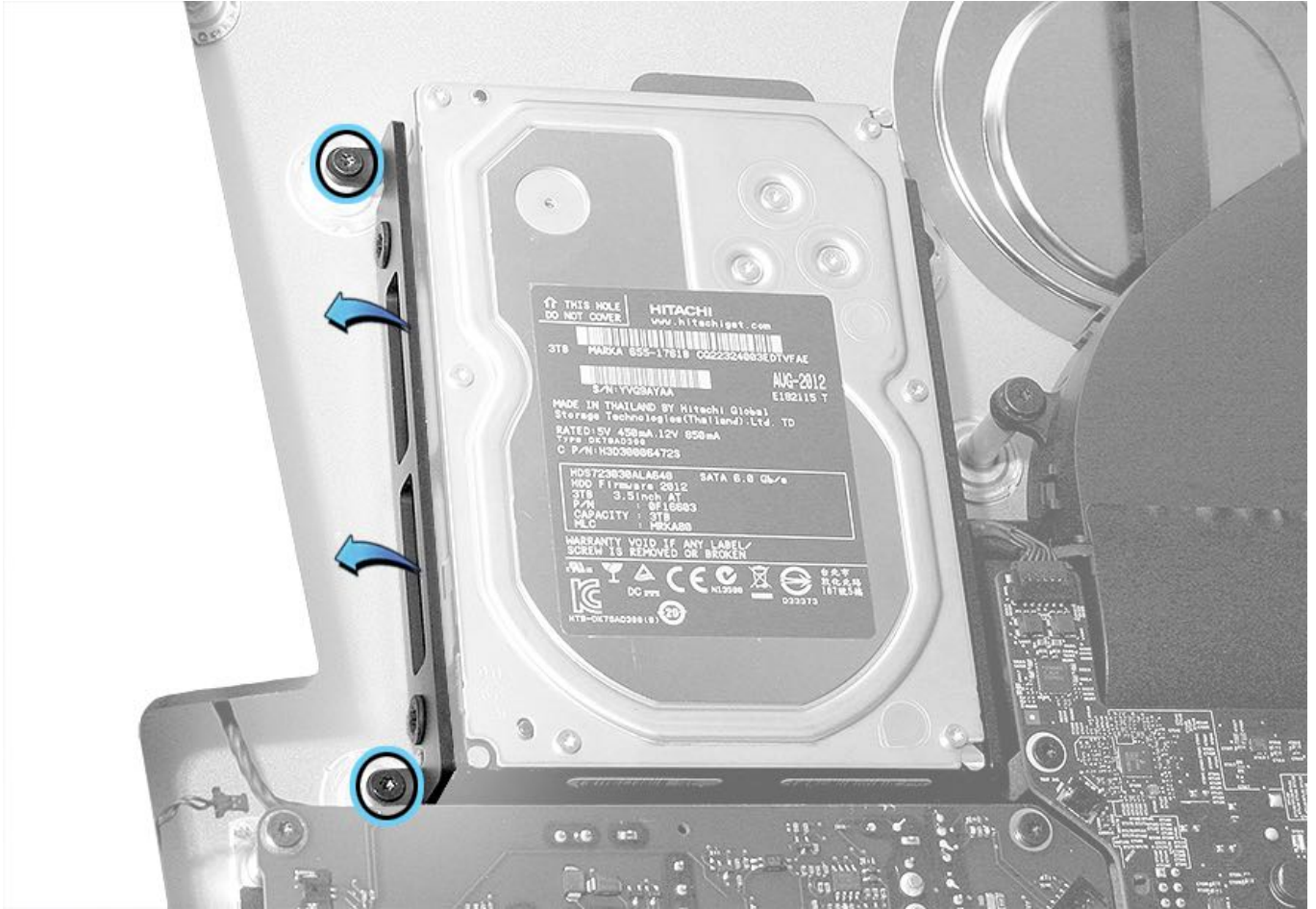
5. Tilt the speaker to the left.

Note: On the iMac (Late 2012 and Late 2013) models, the hard drive must be removed to disconnect the left speaker cable from the logic board. Follow steps 6 and 7 to remove the hard drive. On the iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017) models, the hard drive does not need to be removed to access the speaker cable connector on the logic board. Proceed to removal step 8.

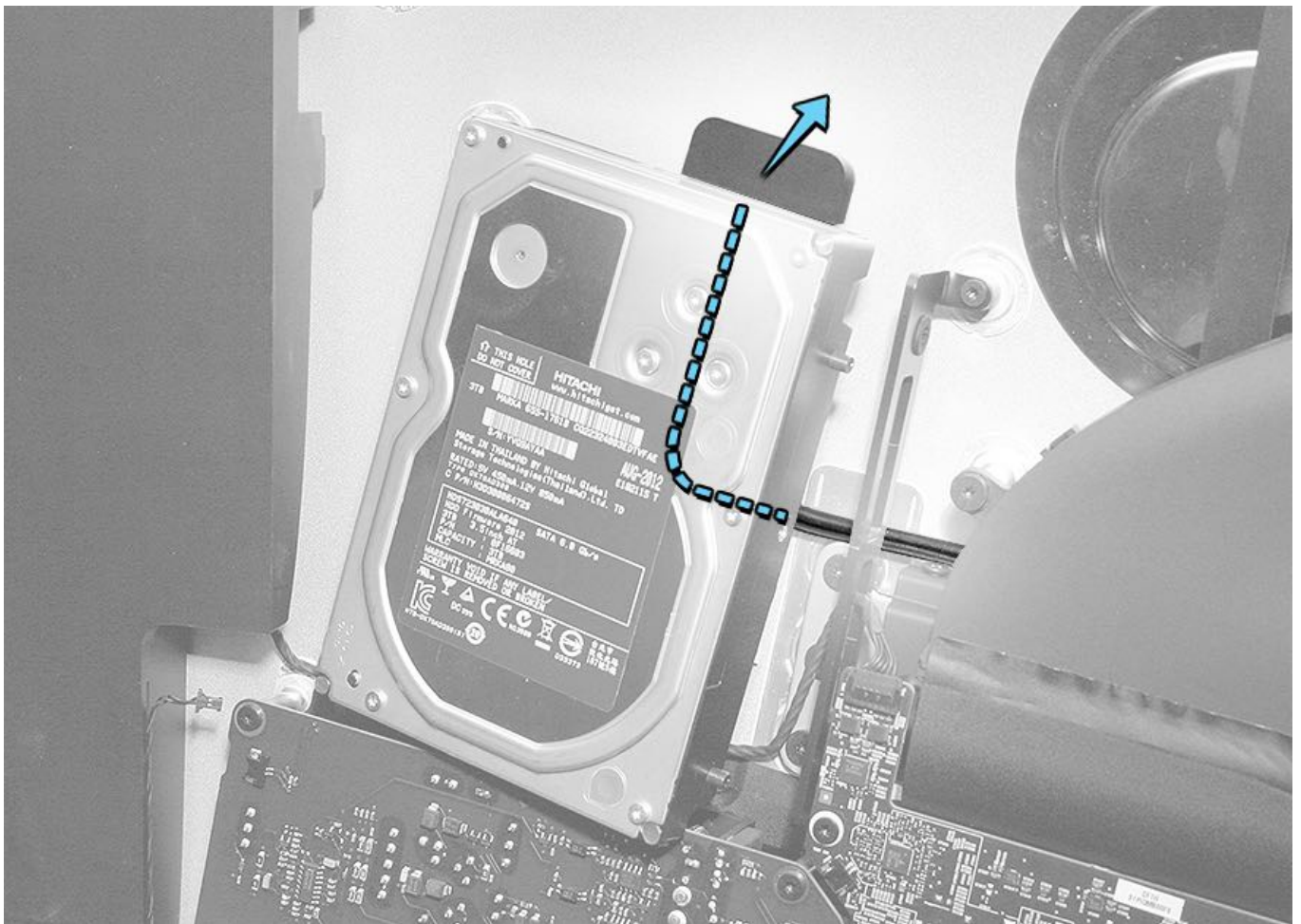


6. Support the hard drive with one hand. Remove two T10 screws from the left mounting bracket.

- T10: 923-0331



7. Disconnect the data and power cable from the top of the hard drive. Slide the hard drive out of the right mounting bracket.



8. Disconnect the speaker cable from the logic board. Lift the speaker out of the rear housing.

Note: The speaker cable runs under the hard drive and the right hard drive bracket. On reassembly, tuck the excess cable under the hard drive or power supply.



Steps For Reassembly

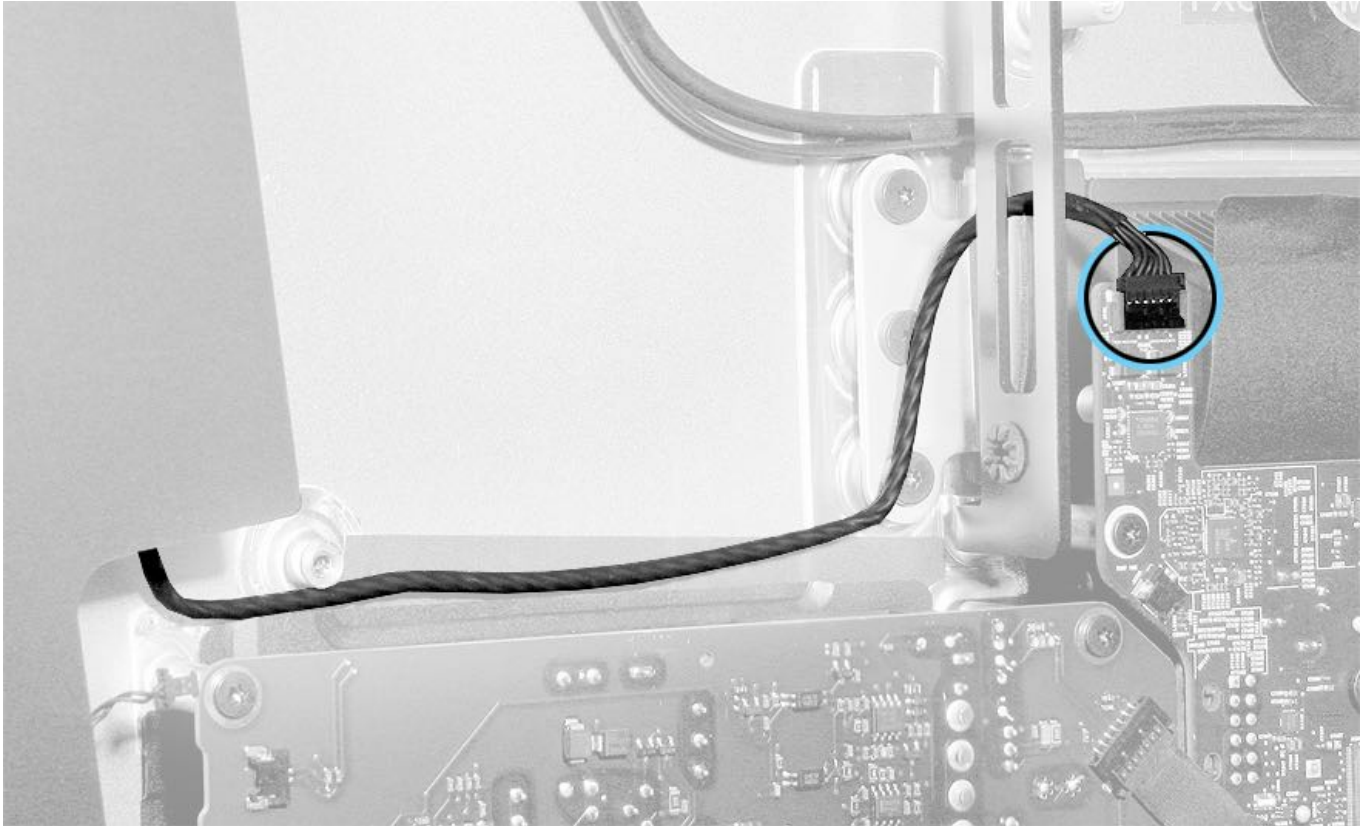
1. Install the power button cable into its routing groove on the left speaker.

Important: If the power button cable breaks, then the rear housing will need to be replaced. The power button cable is part of the rear housing.

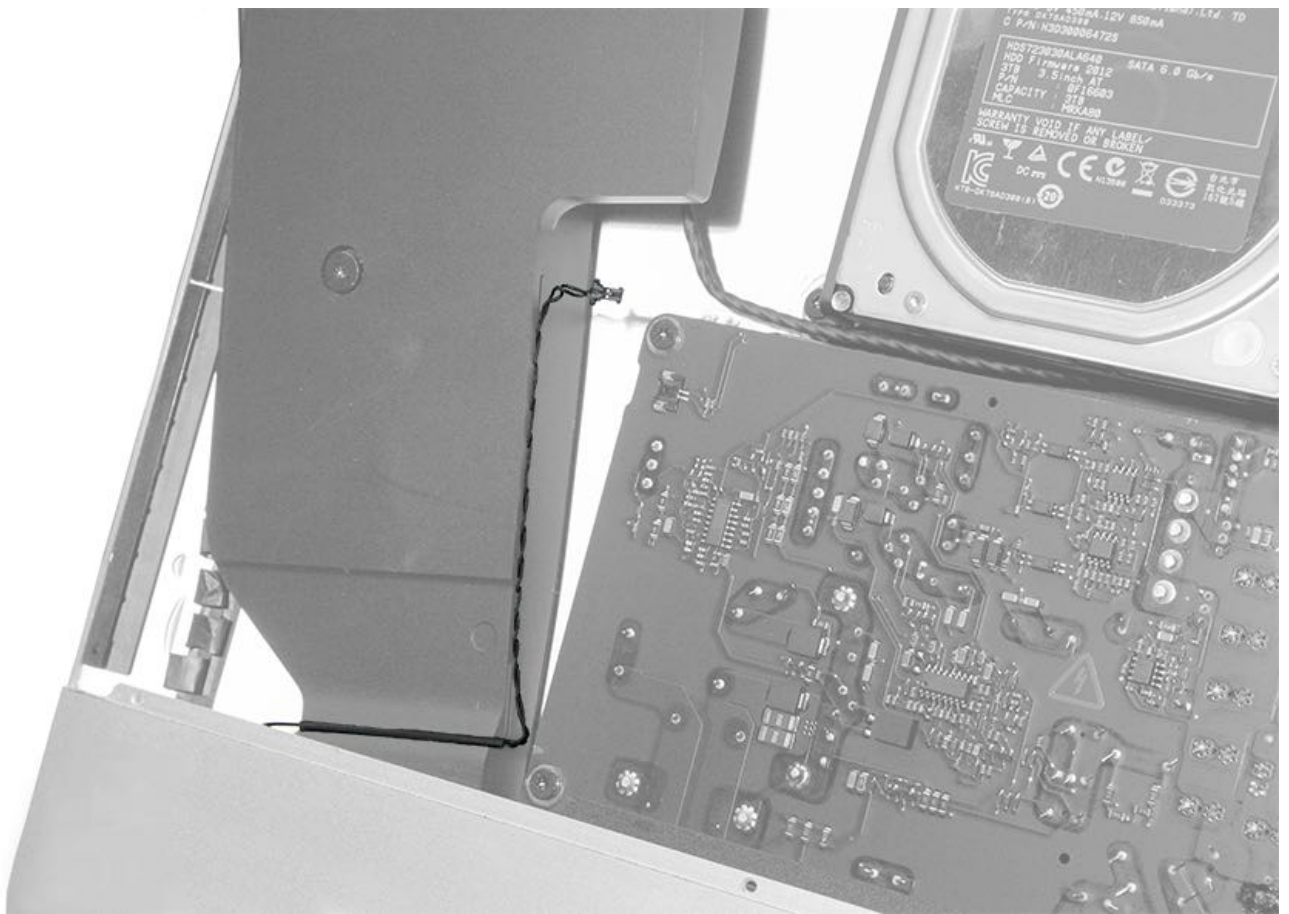
2. On the iMac (Late 2012 and Late 2013) models, install the left mounting bracket (using two T10 screws) and hard drive. If you are repairing an iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017) model, then go to the next step.

3. Route the speaker cable along the top edge of the power supply and under the right mounting bracket.

4. Connect the speaker cable to the logic board.



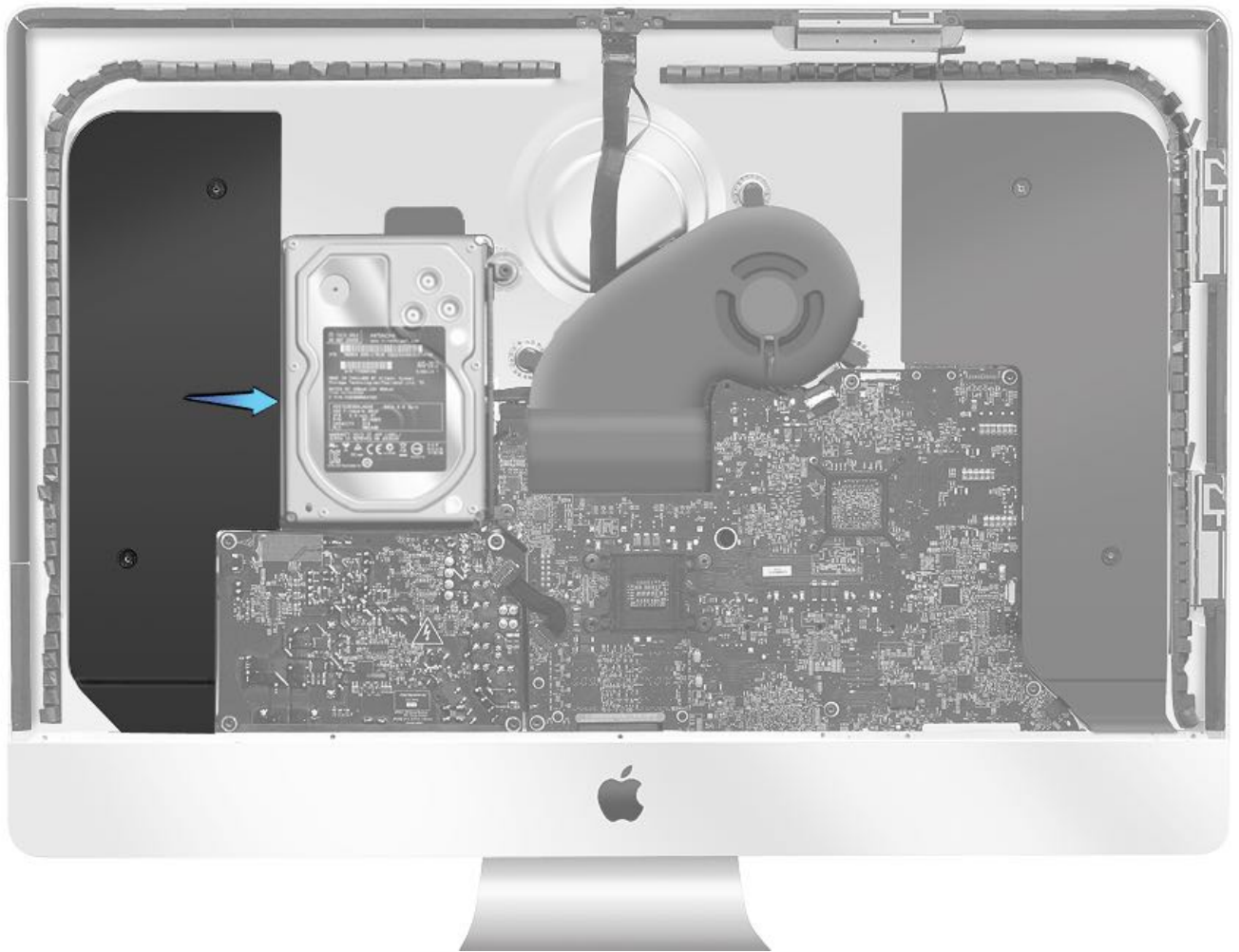
5. Position the speaker in the rear housing. Ensure that the power button cable does not bind or slip out of the routing groove as you place the speaker into the rear housing.



6. Lower the speaker the rest of the way into the rear housing.



7. Correct spacing between the left speaker and hard drive requires inserting a 1.85 mm shim between the left speaker and hard drive (shown by the arrow below). Stack 18 individual sticky notes to make a 1.85 mm shim. Insert the shim between the speaker and hard drive. Tighten the speaker screws after inserting the shim.

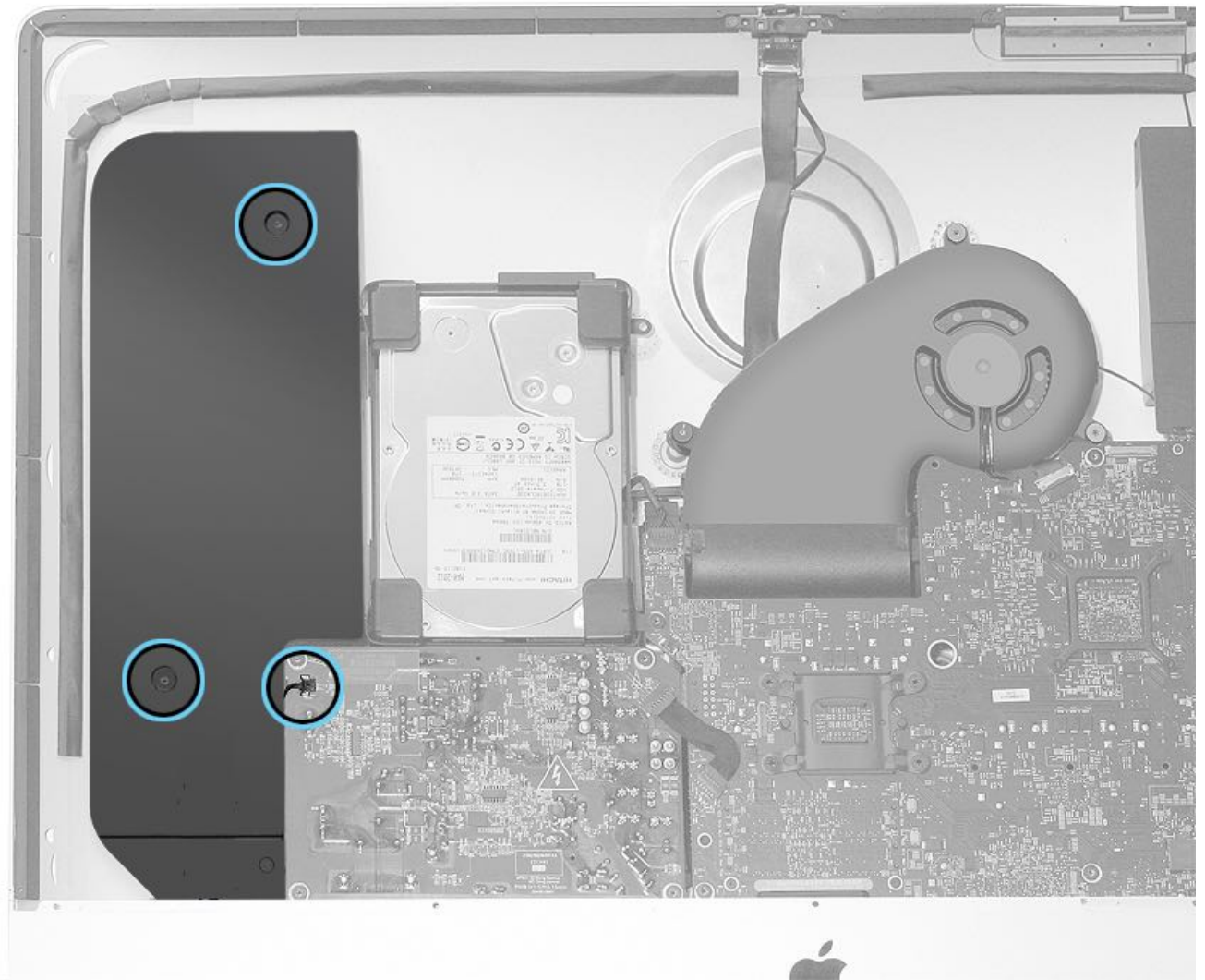


8. Connect the power button to the power supply.

9. Install two T10 screws.

- T10: 923-0333, 10 mm





10. Reinstall the [chin strap](#).
11. Install new [display panel VHB strips](#).
12. Reinstall the [display panel](#).

Hard Drive

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV244: Hard Drive Replacement Video](#).

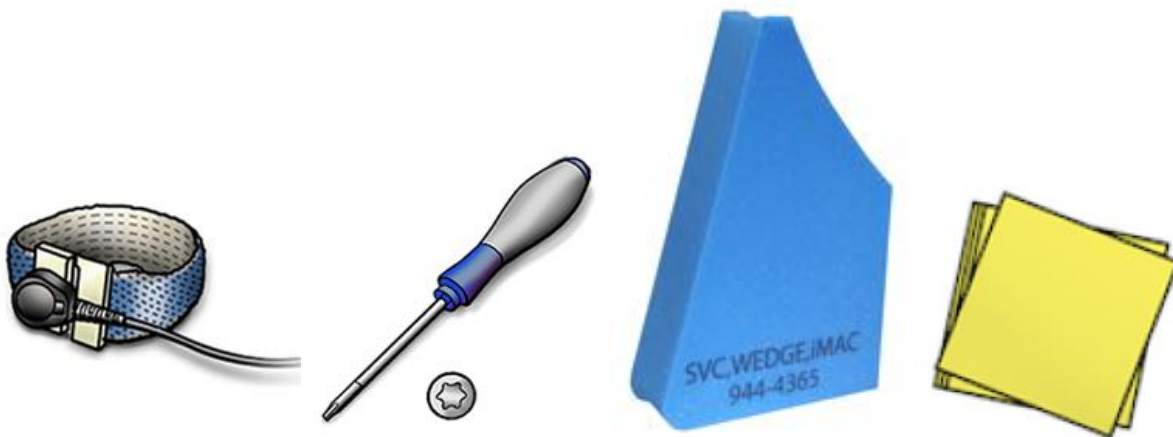
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Left speaker](#)



Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)
- Service wedge (iMac)
- Sticky notes



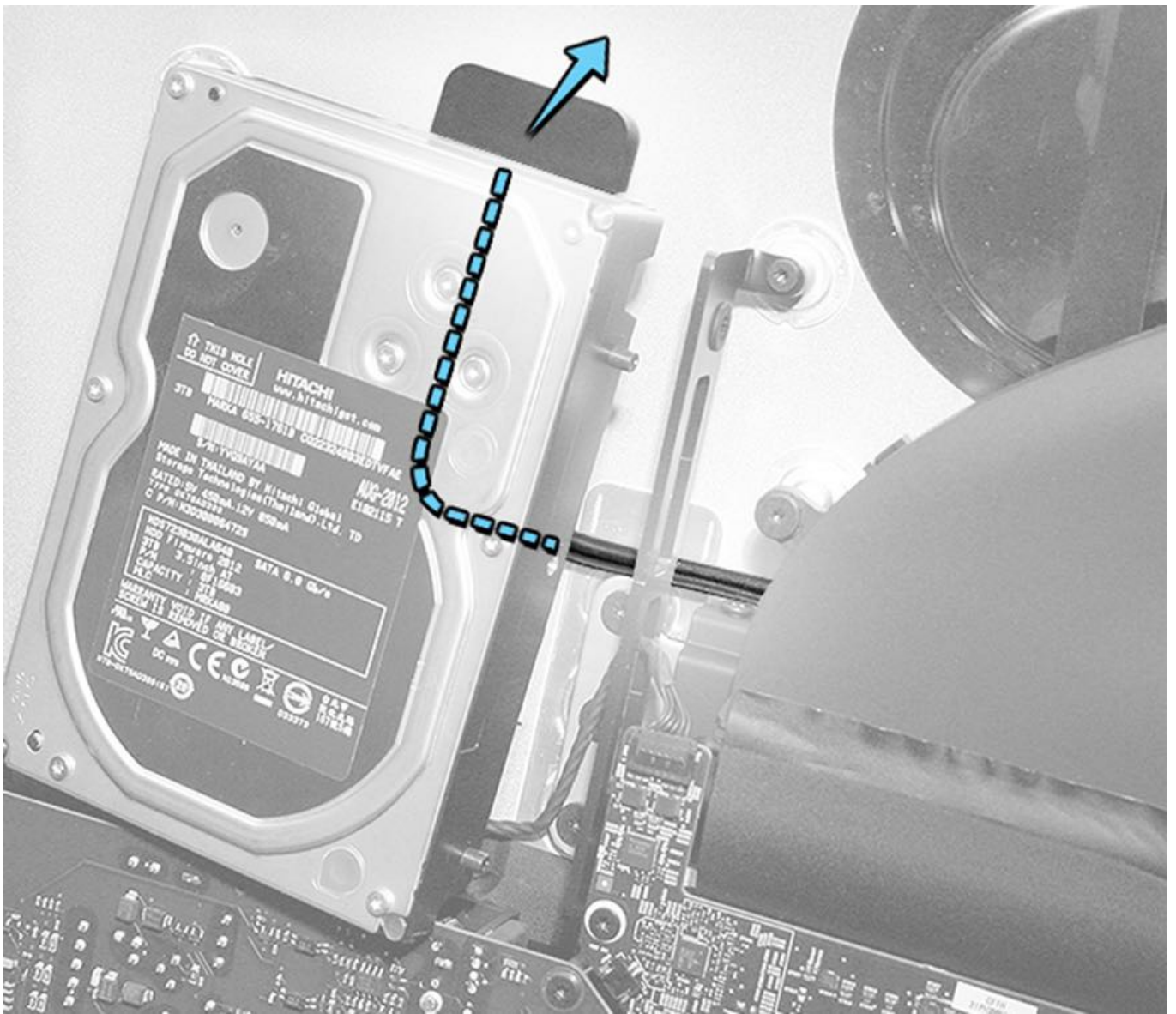
Steps For Removal

1. While supporting the hard drive with one hand, remove two screws from the left mounting bracket. Slide the hard drive out of the rubber grommets on the right mounting bracket.

- T8: 923-0331

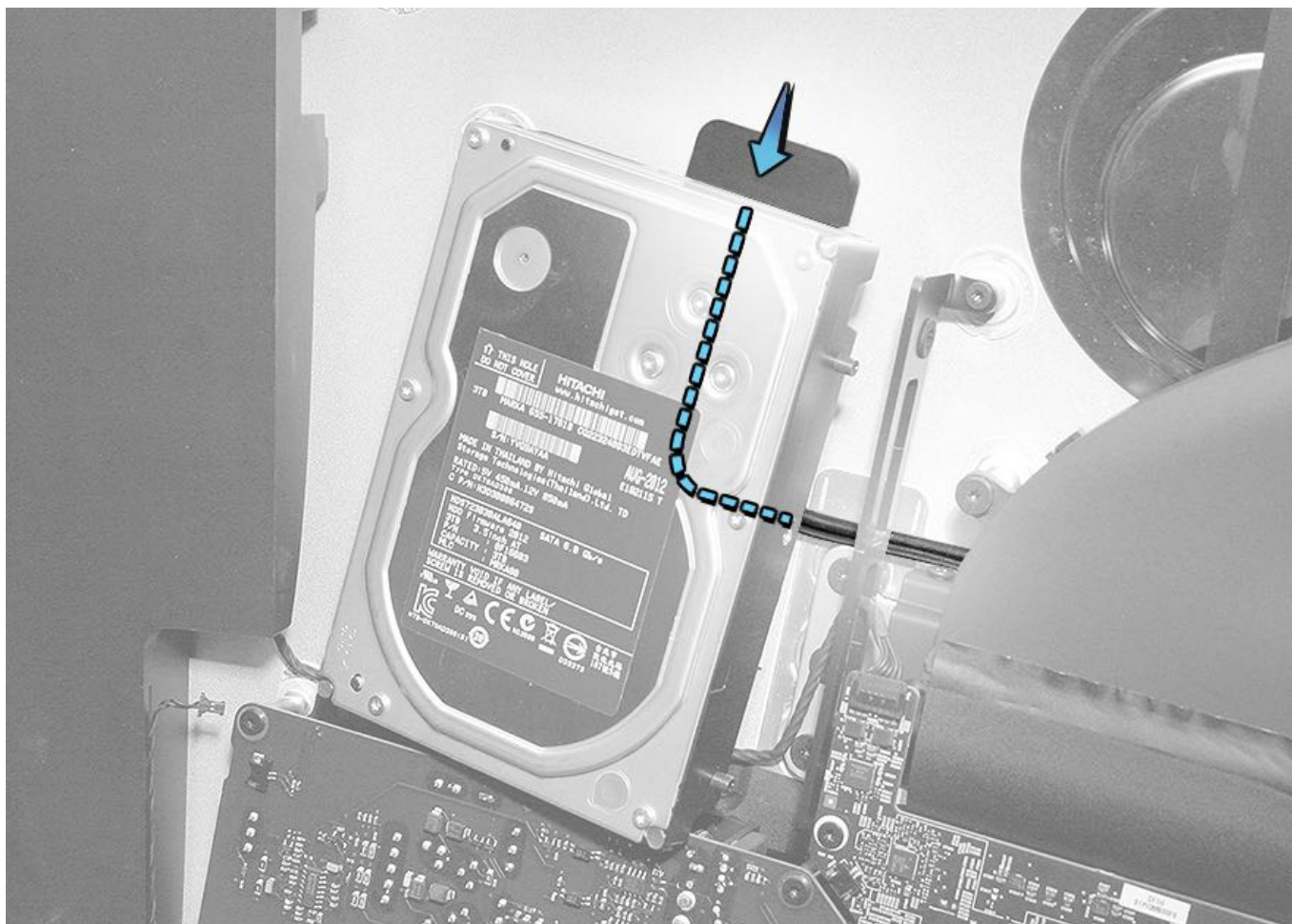


2. Disconnect the hard drive data cable from the top of the hard drive.

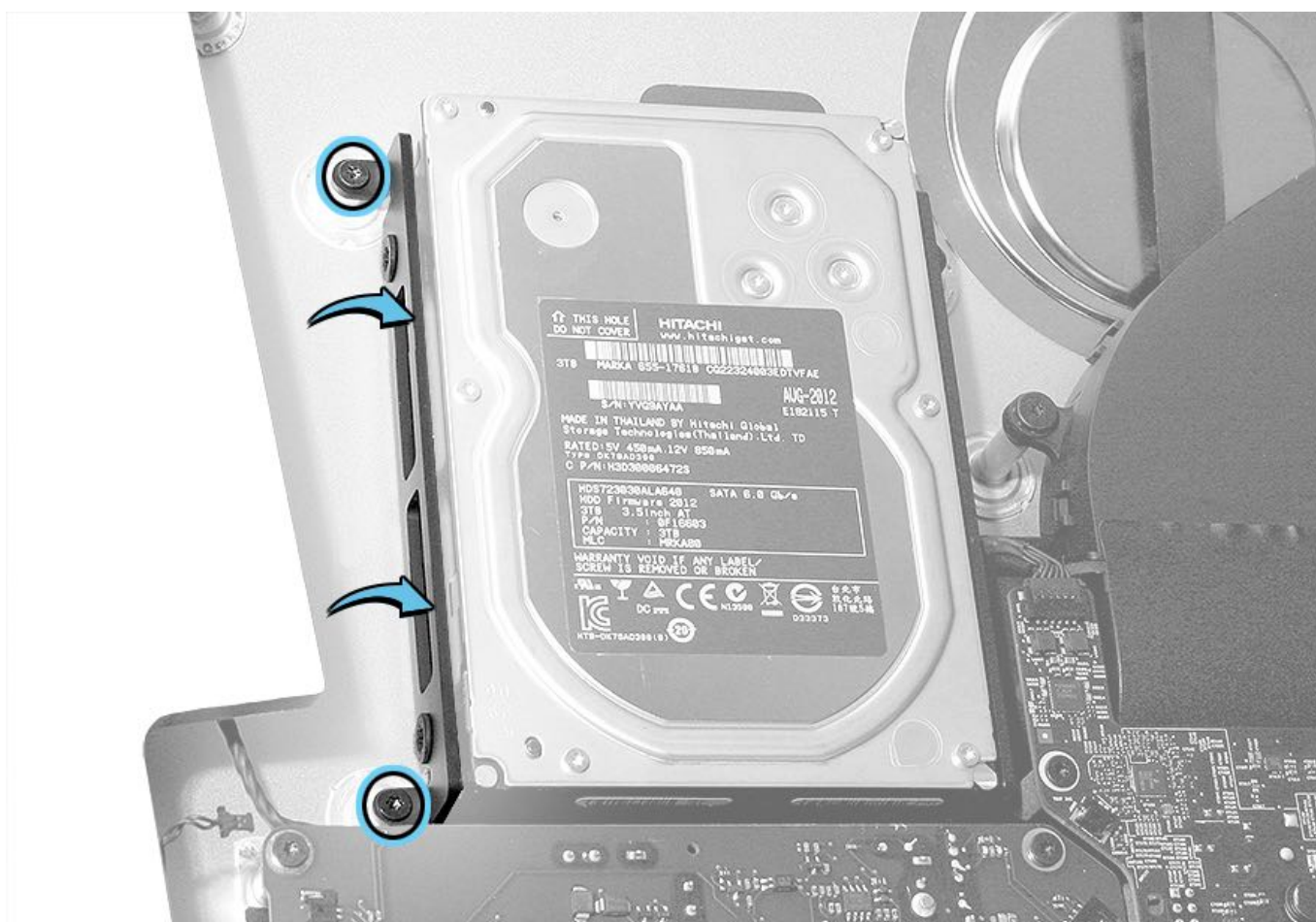


Steps For Reassembly

1. If installing a replacement hard drive, transfer the four T8 screw pins.



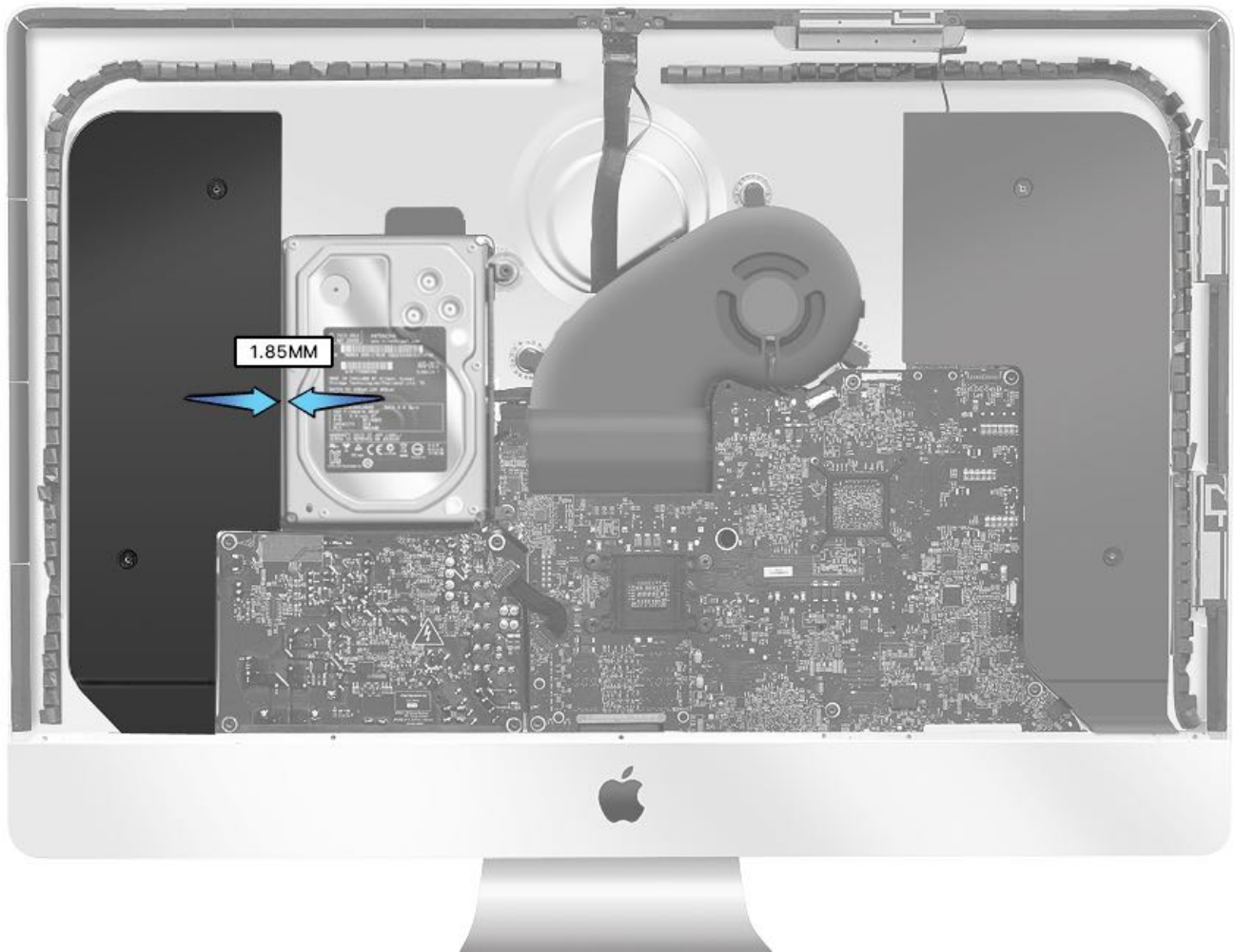
4. Reinstall the left hard drive bracket and bracket screws.



5. Reinstall the [left speaker](#) into the rear housing.

6. Connect the power-on cable to the power supply.

7. Correct spacing between the left speaker and hard drive requires inserting a 1.85 mm shim between the left speaker and hard drive (shown by arrows below). Stack 18 individual sticky notes to make a 1.85 mm shim. Insert the shim between the speaker and hard drive. Tighten the speaker screws after inserting the shim.



8. Reinstall the [chin strap](#).

9. Install new [display panel VHB strips](#).

10. Reinstall the [display panel](#).

11. Refer to article [TP767: Reinstalling Software That Came with the Computer](#).

Reinstalling Software That Came with the Computer

Reinstalling Software That Came with the Computer

This procedure requires an Internet connection.

Note: In some situations, a user may have set a firmware password. The user must know the firmware password in order to reinstall OS X or macOS. If the user cannot remember the password, then refer to the technician instructions in [HT204455: How to set a firmware password on your Mac](#).

Important: Apple recommends that users back up their data before any software restore procedure. Back up essential files before installing OS X or macOS. Apple is not responsible for any loss of data. For instructions on using Time Machine, refer to [HT201250: How to use Time Machine to back up or restore your Mac](#).

For instructions on reinstalling the OS, follow the steps in [HT204904: How to reinstall macOS](#).

For more information about recovery mode, refer to [HT201314: About macOS Recovery](#).

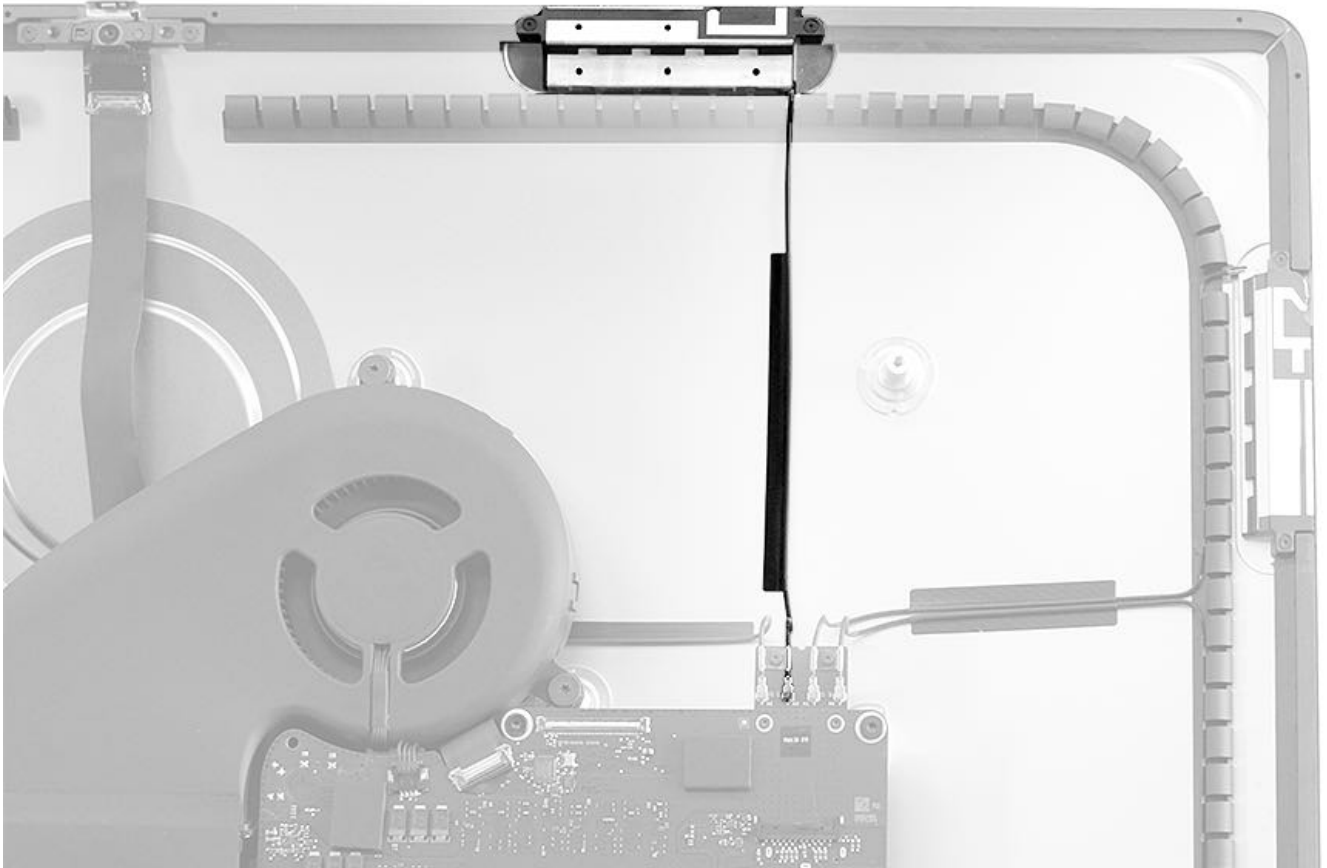
Bluetooth Antenna

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

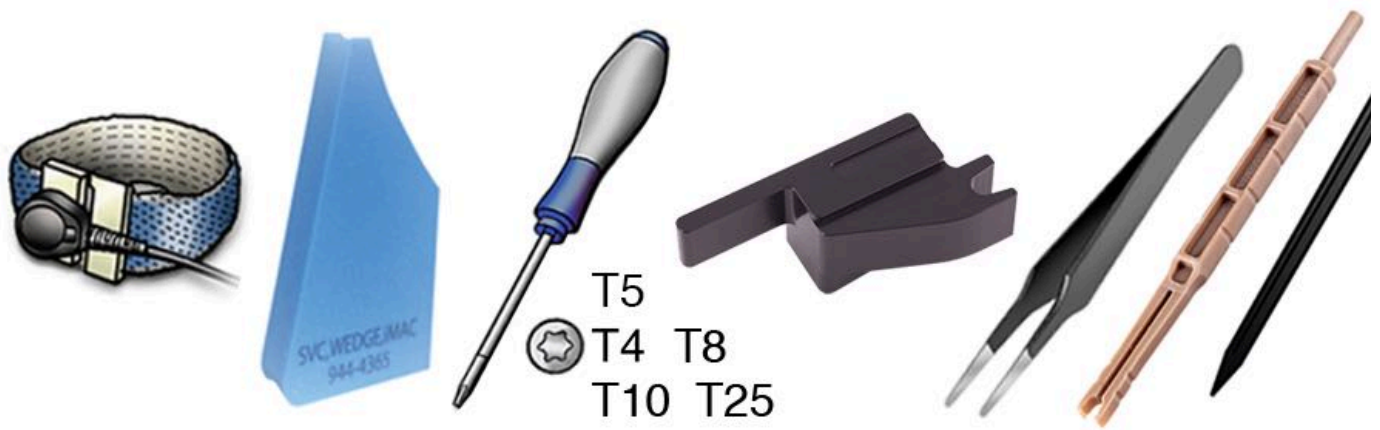
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



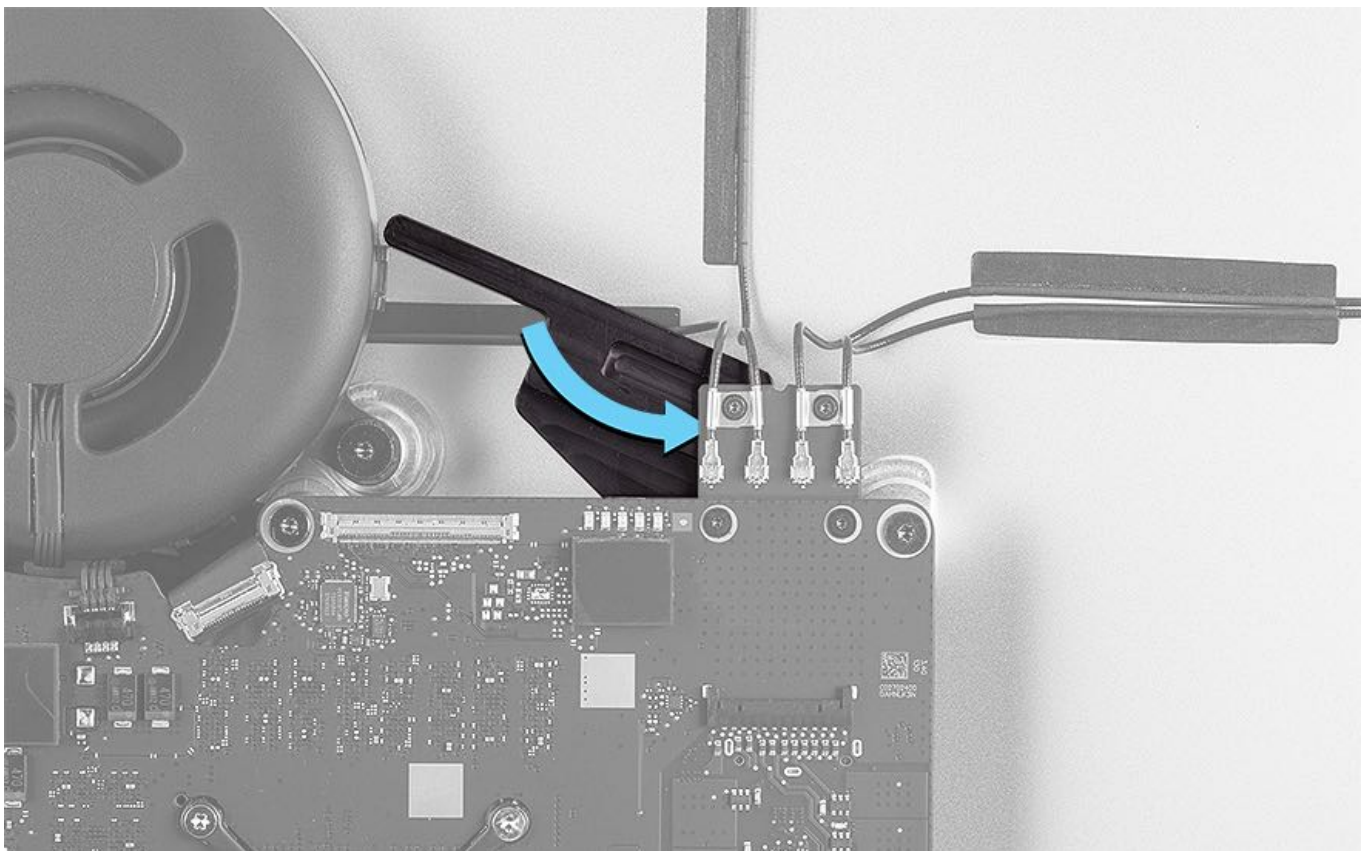
Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- Torx T4 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Wireless card support tool (923-01807)
- ESD-safe tweezers
- Black stick

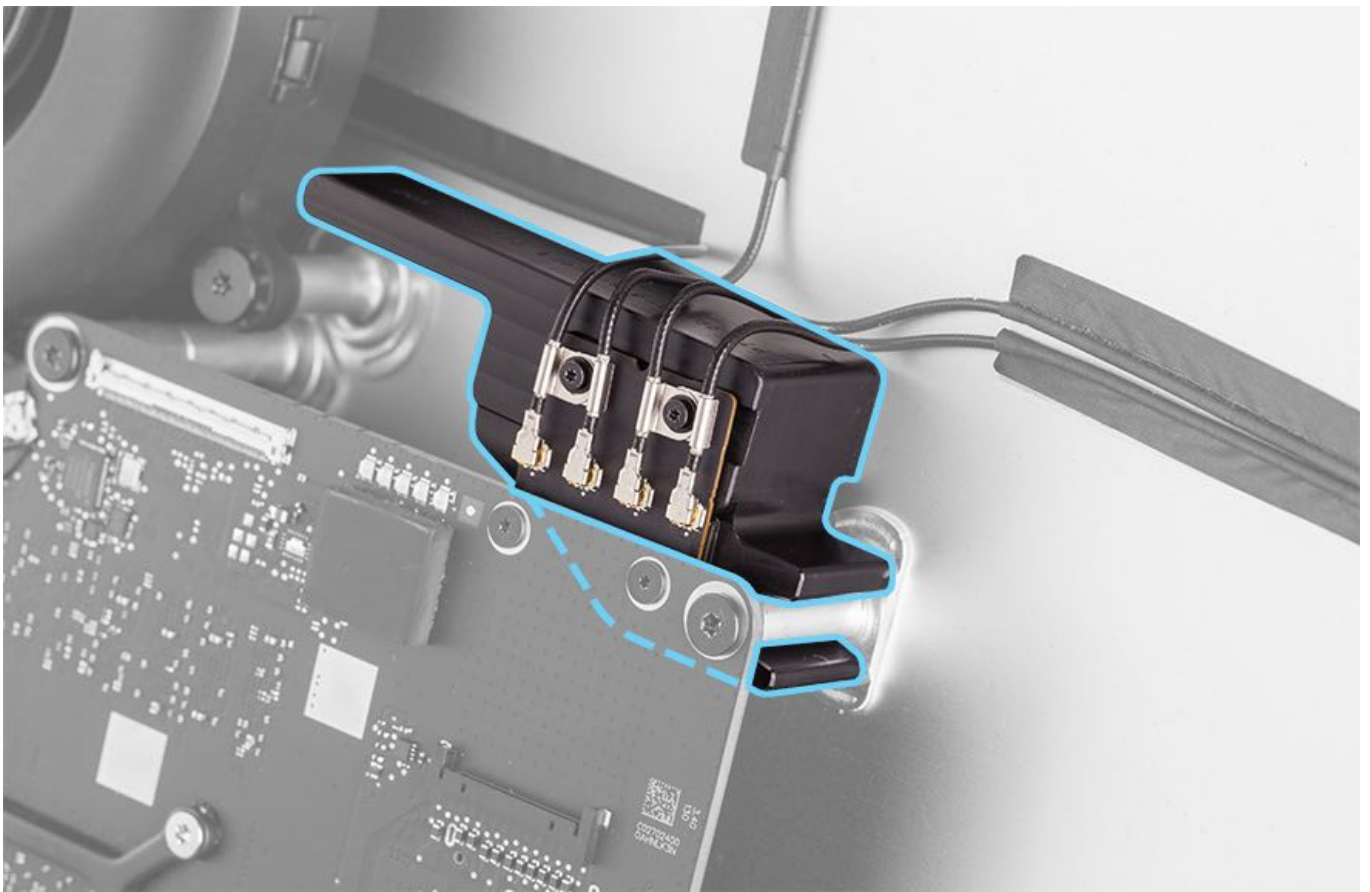


Steps For Removal

1. To protect the wireless card, slide the wireless card support tool into place between the rear housing and the wireless card.

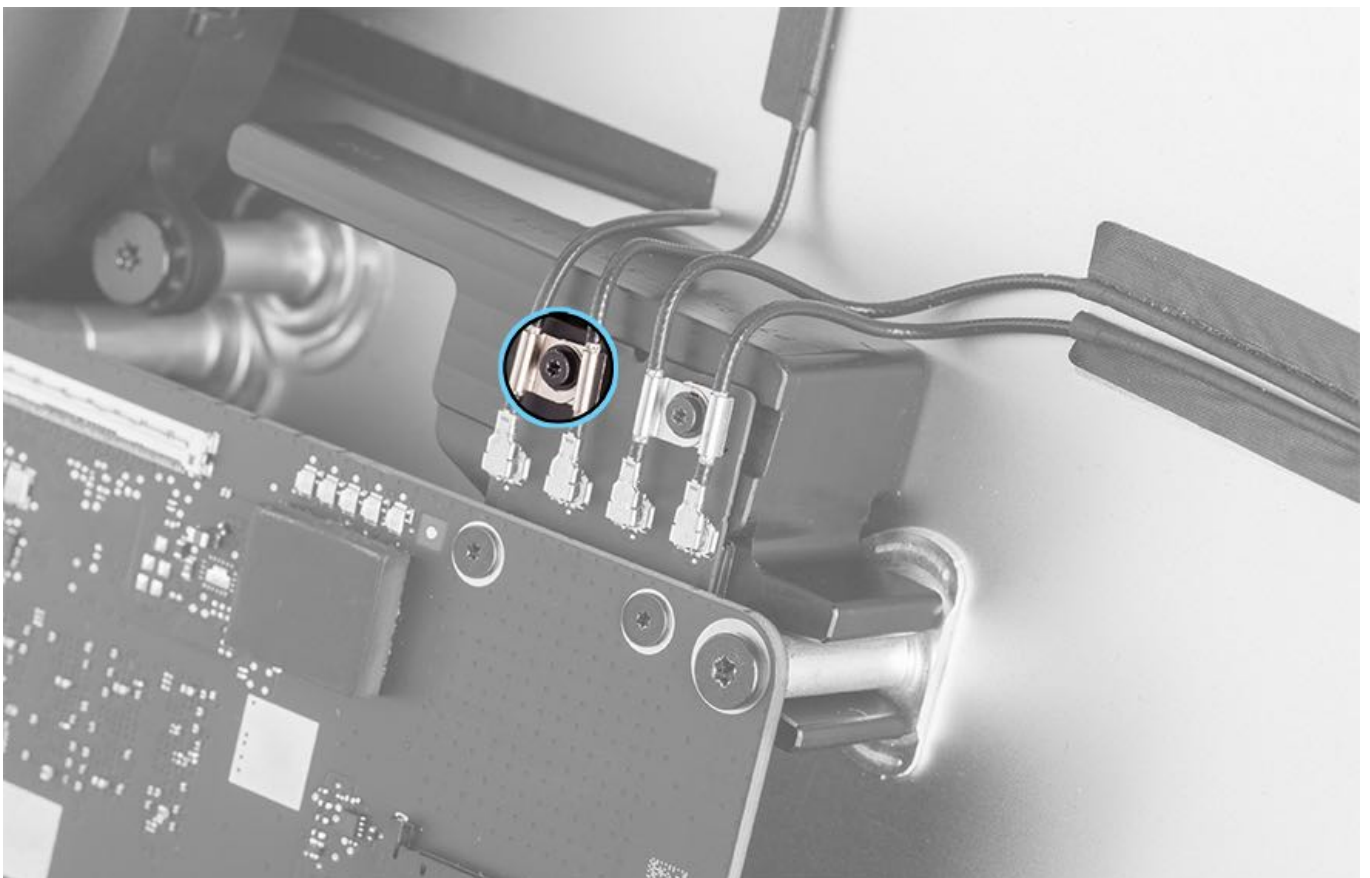


2. Keep the support tool in position while removing or replacing screws and when disconnecting or reconnecting antenna cables.



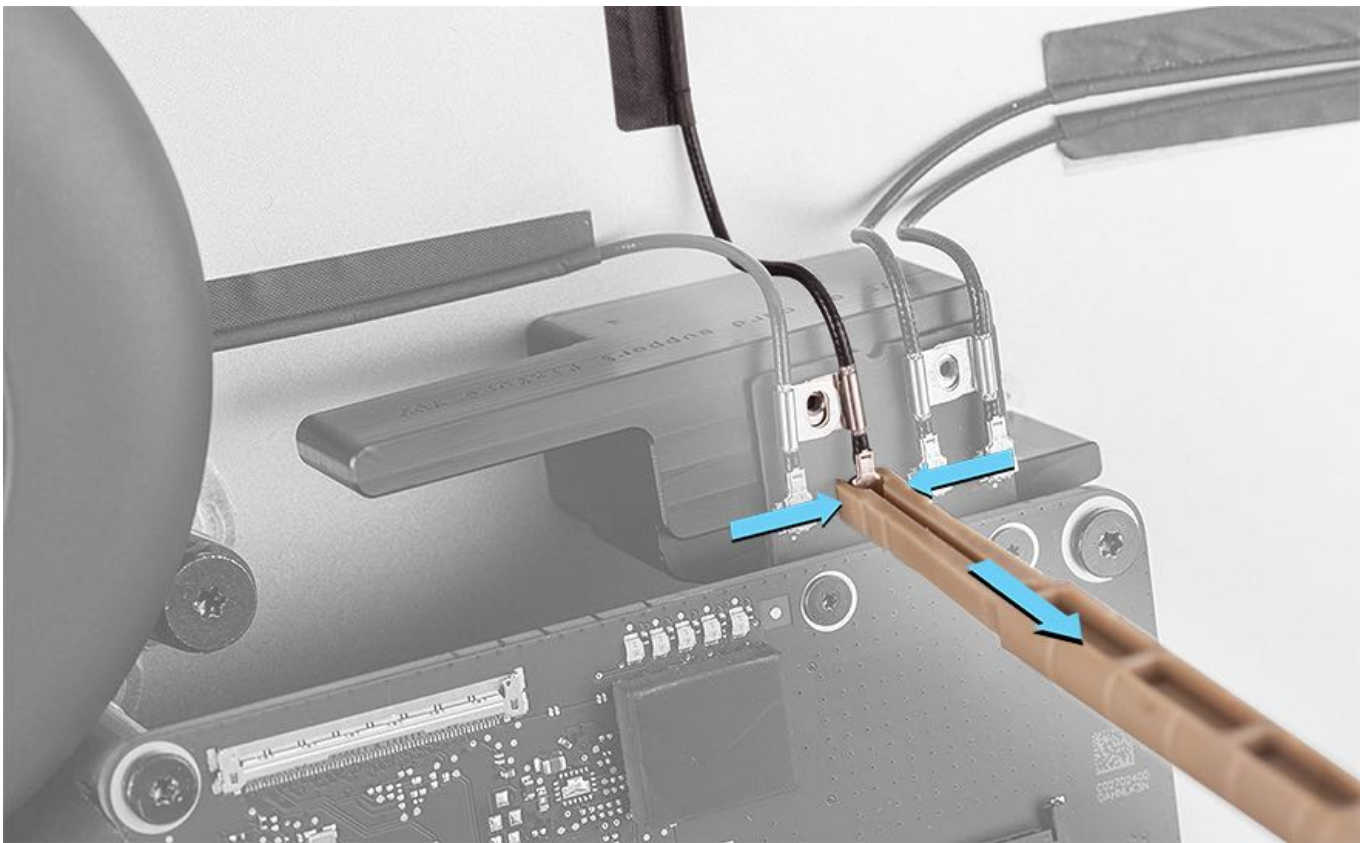
3. Remove the T5 screw from the wireless card.

- T5: 923-01667

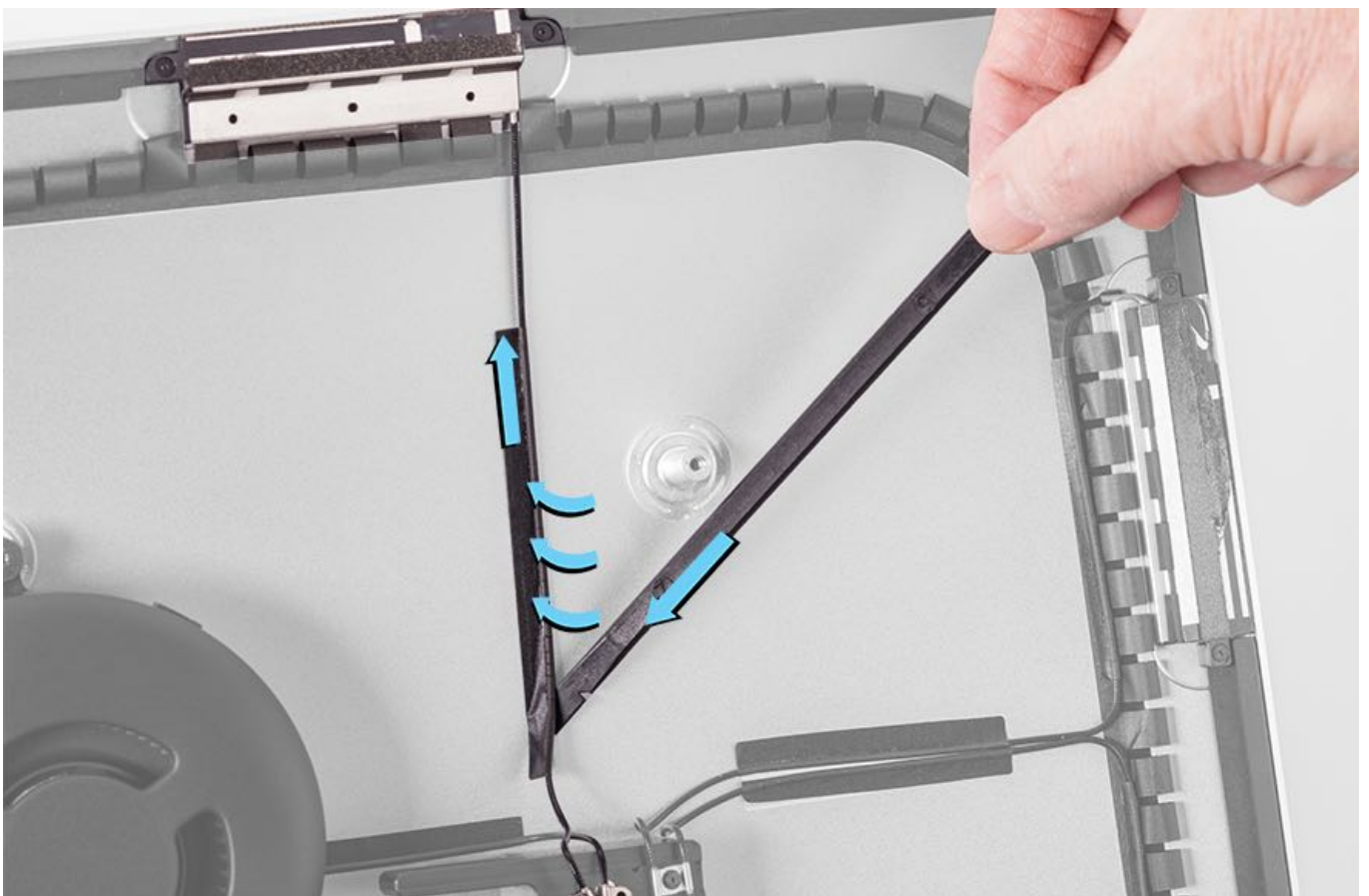


4. Use the antenna tool or ESD-safe tweezers to disconnect the connector from the wireless card.

Note: Avoid using a metal tool that could crimp or damage the cable.



5. Use a black stick or your fingers to gently remove the tape from the rear housing.



6. Remove two T4 screws that secure the antenna body to the rear housing.

- T4: 923-0304



7. Remove the Bluetooth antenna from the computer assembly.



Steps For Reassembly

1. Install two T4 screws to secure the antenna body to the rear housing.

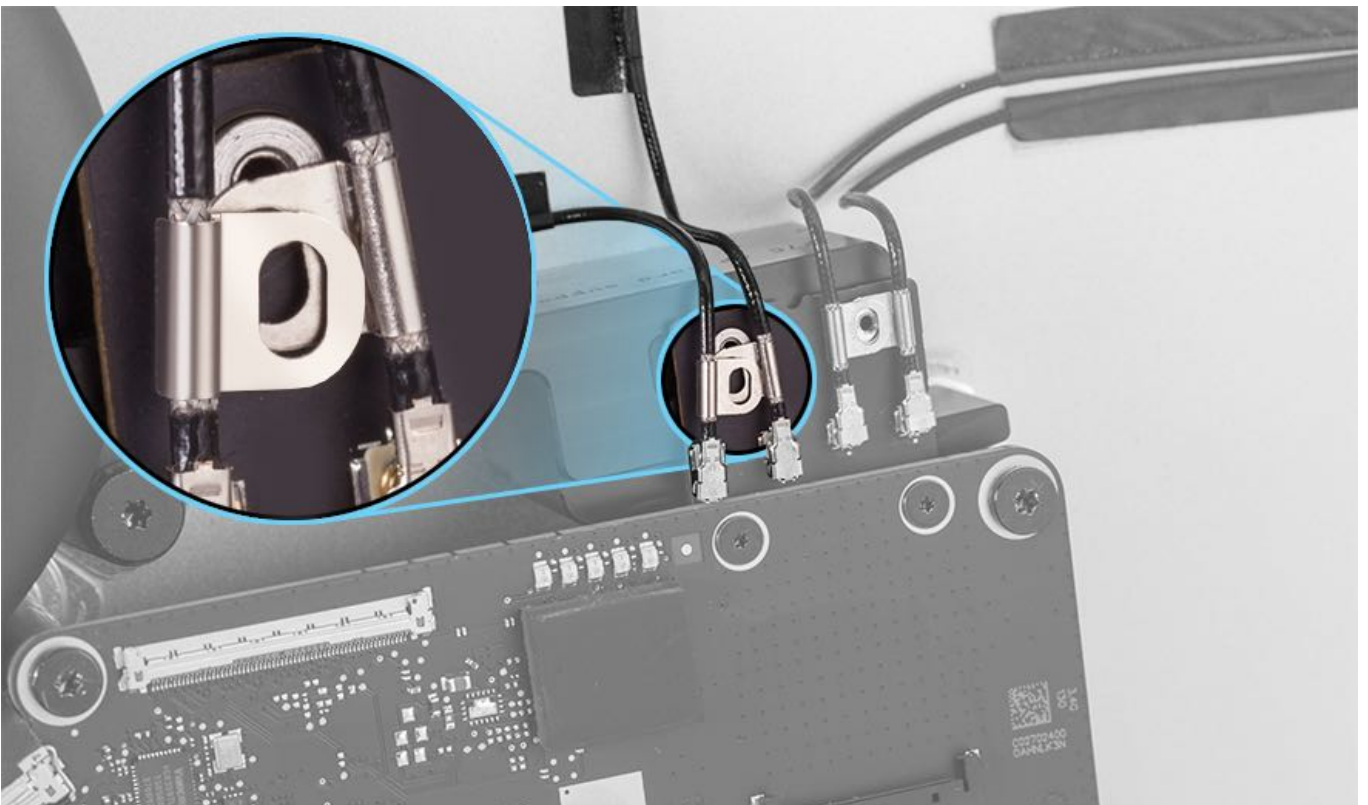
- T4: 923-0304





2. Attach the antenna cable tape to the housing. Secure the antenna tape to the rear housing.

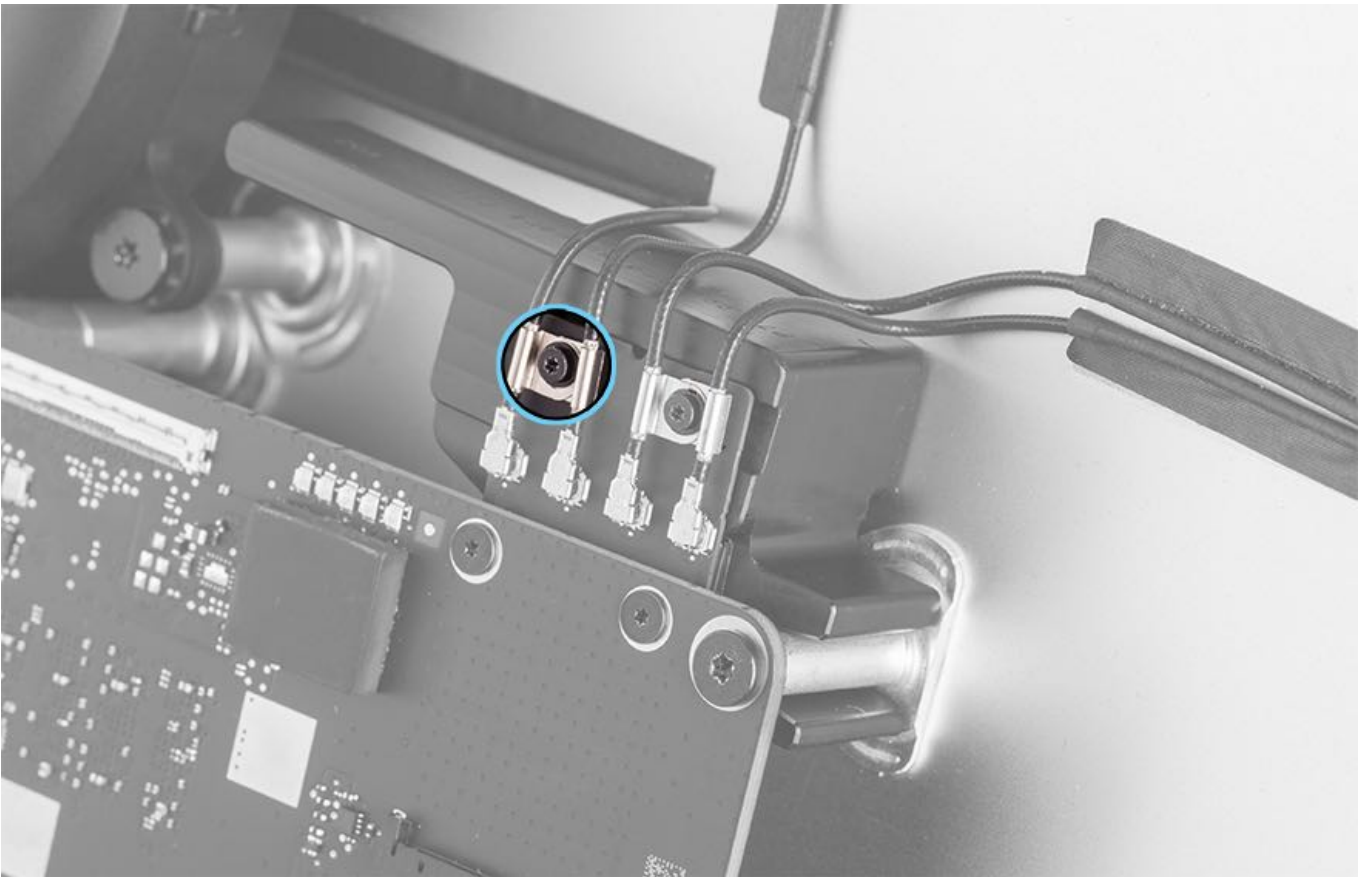
3. Slide the right bracket under the left bracket.



4. Use the antenna tool or ESD-safe tweezers to connect the cable to the wireless card.

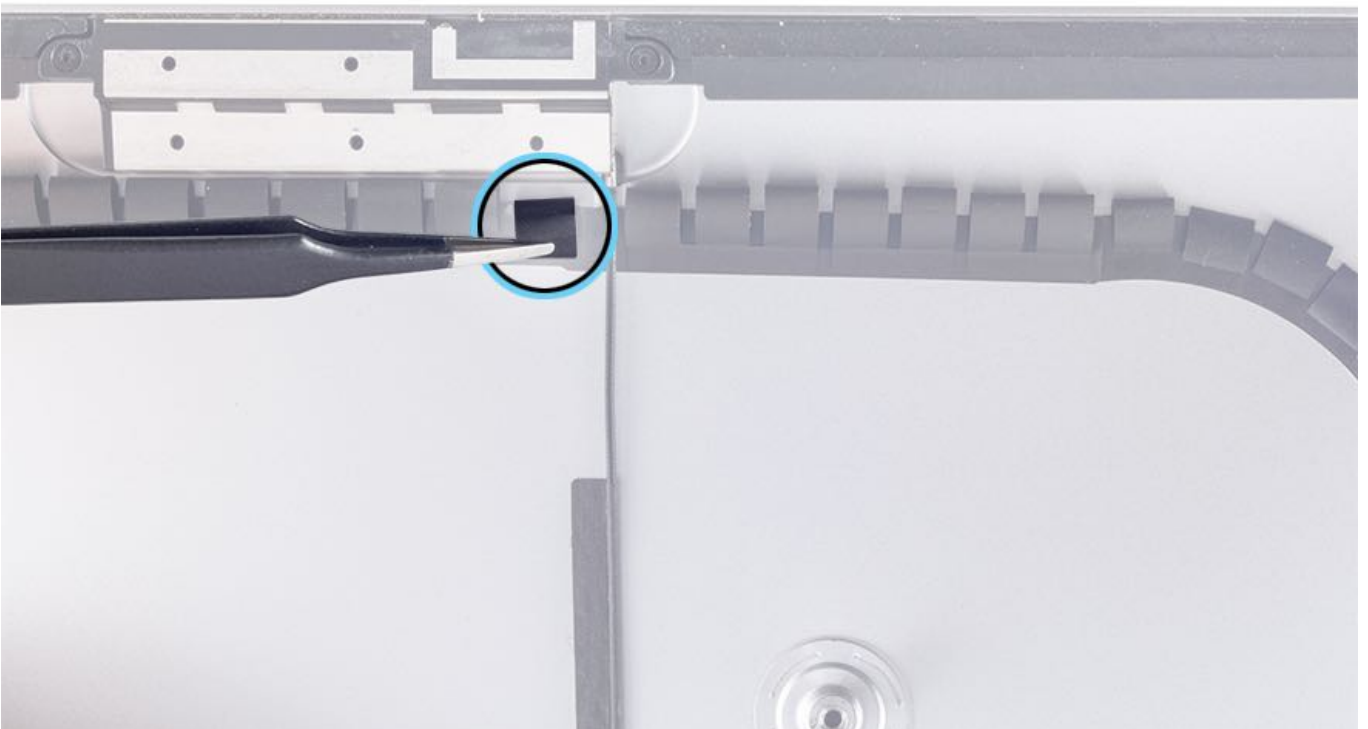
5. Install the T5 screw to the wireless card.

- T5: 923-01667



6. Remove the wireless card support tool from the rear housing.

7. Check the airloop gasket and use a black stick or tweezers to open any flattened loops.



8. Reinstall the [right speaker](#).

9. Reinstall the [chin strap](#).

10. Install new [display panel VHB strips](#).

11. Reinstall the [display panel](#).

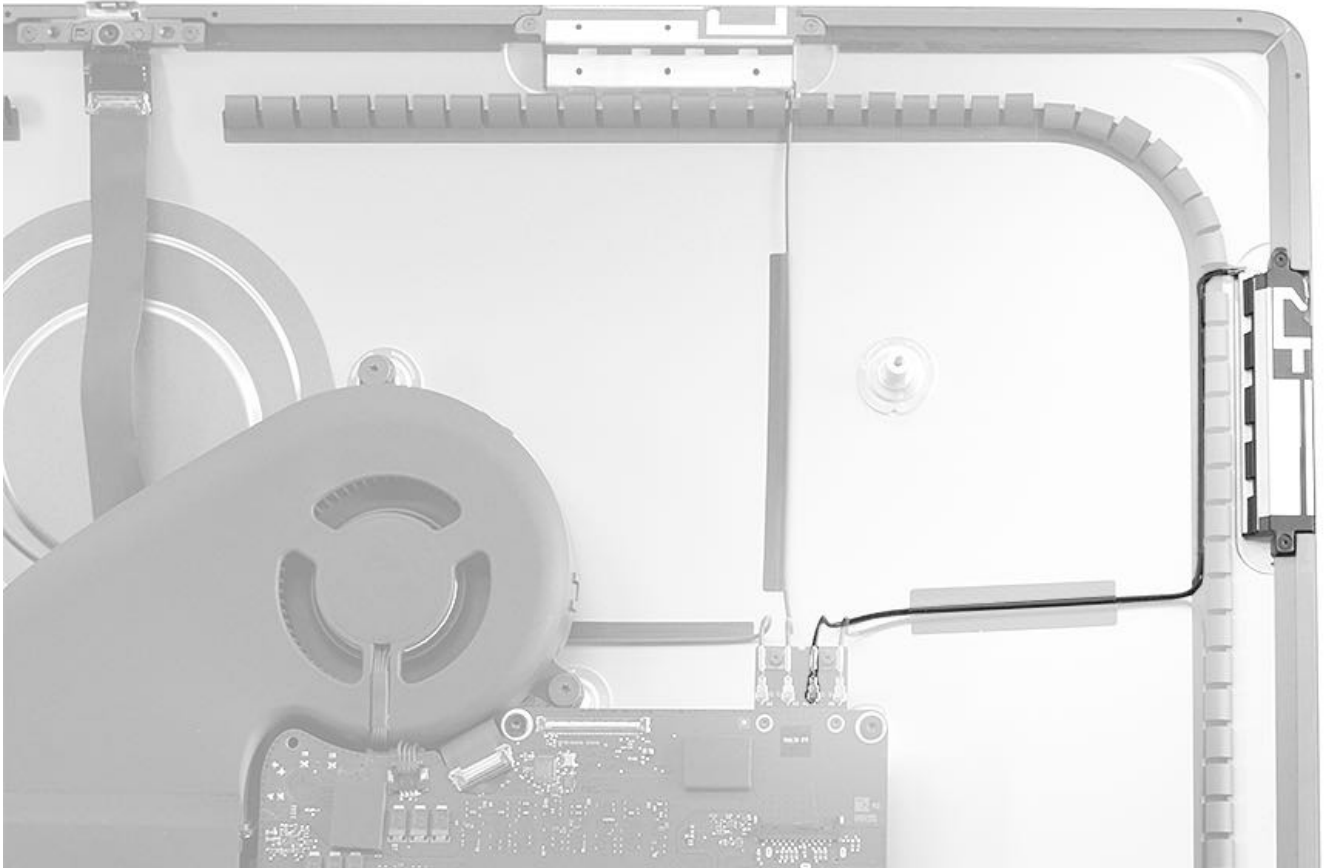
Middle Wi-Fi Antenna

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

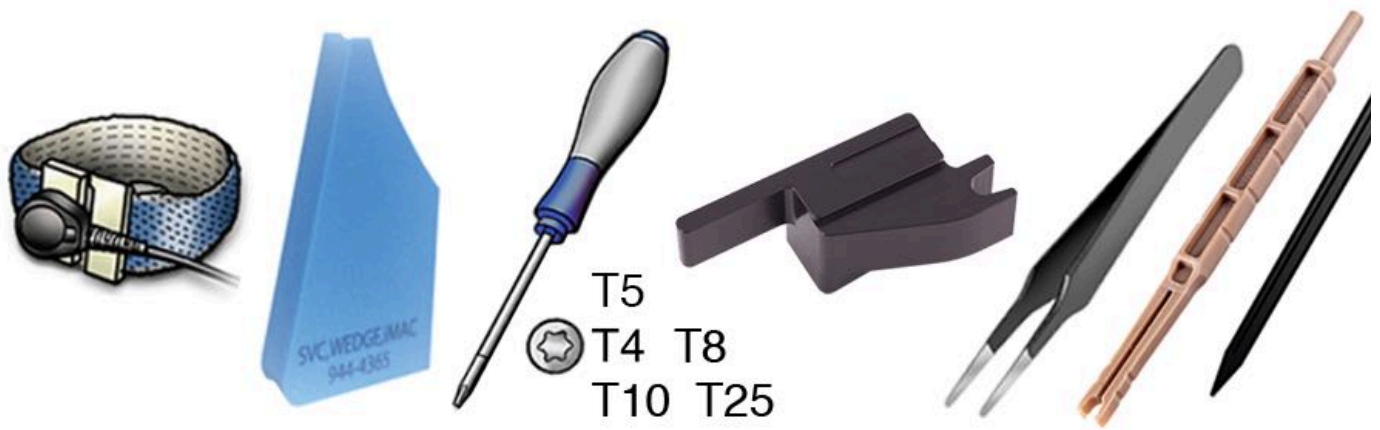
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



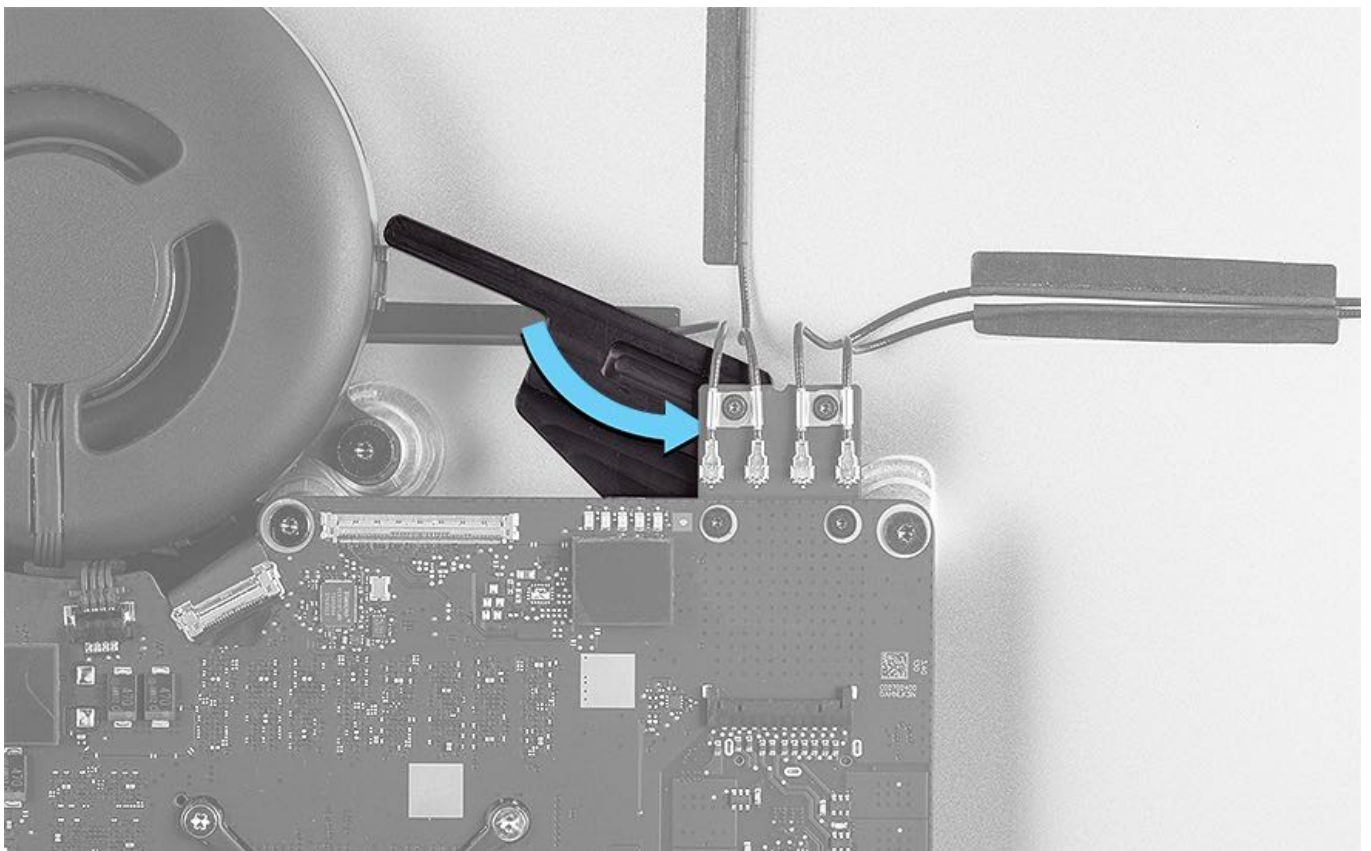
Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- Torx T4 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Wireless card support tool (923-01807)
- ESD-safe tweezers
- Black stick

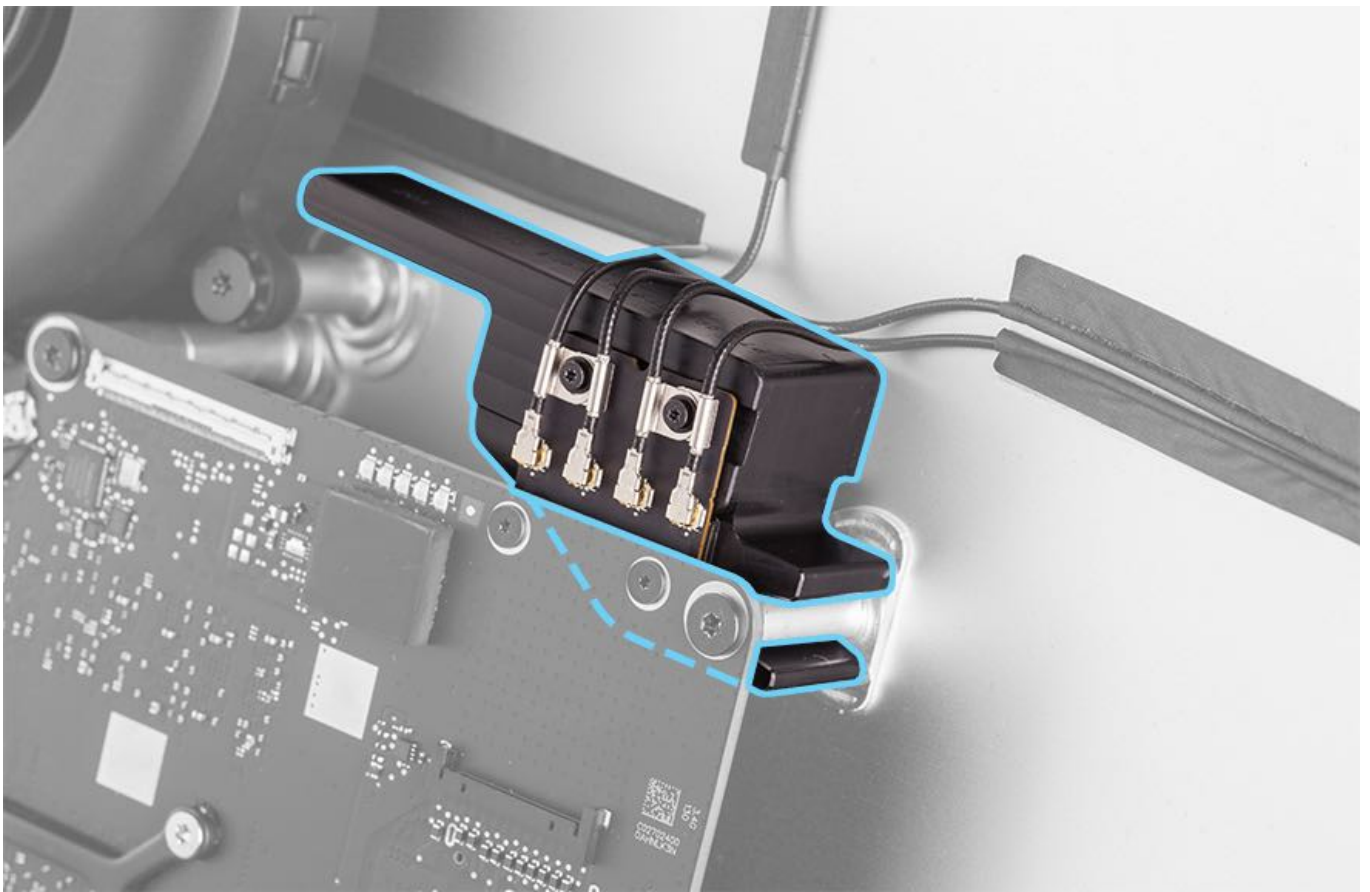


Steps For Removal

1. To protect the wireless card, slide the wireless card support tool into place between the rear housing and the wireless card.

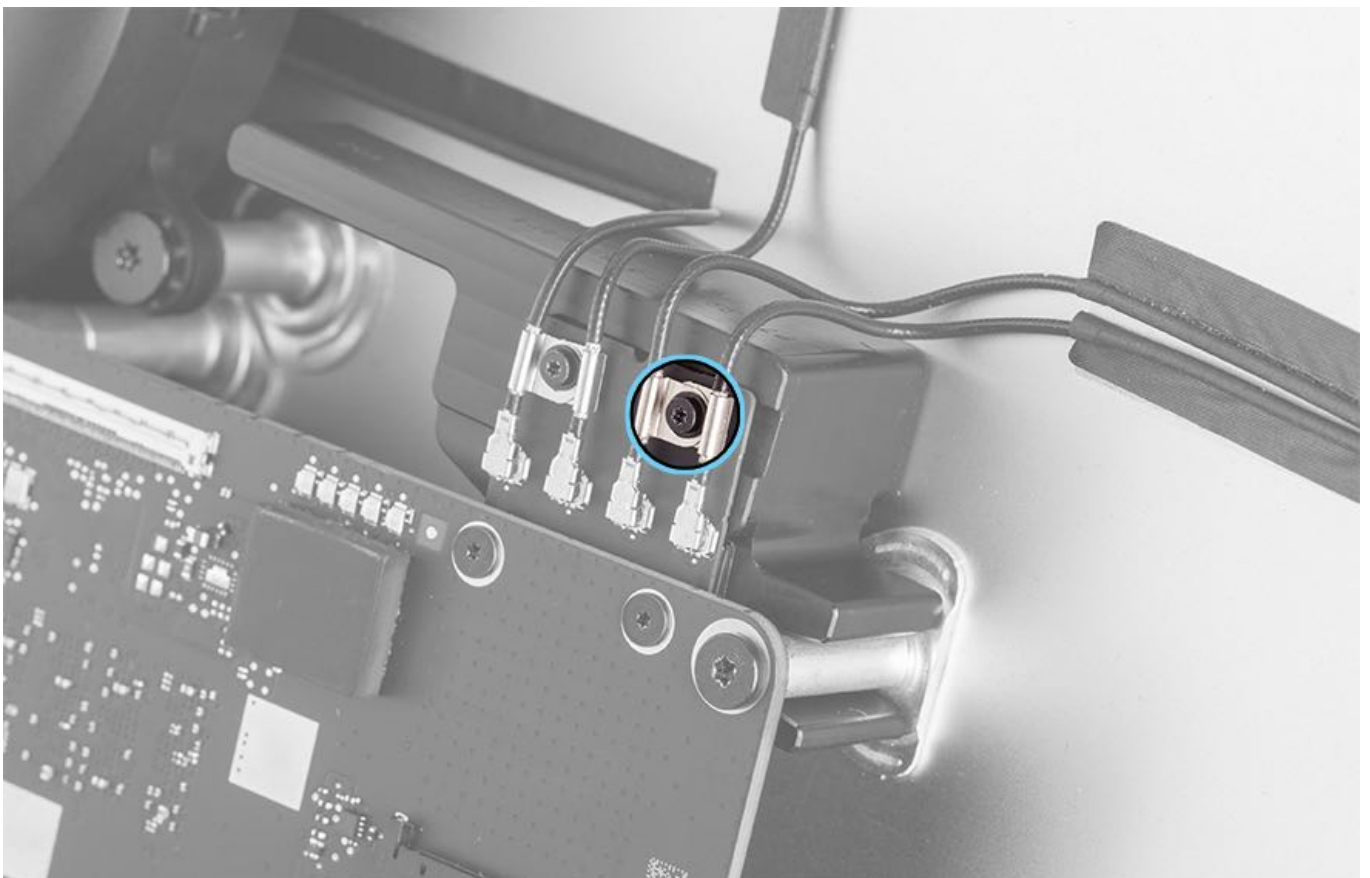


2. Keep the wireless support tool in position while removing or replacing screws and disconnecting or reconnecting antenna cables.



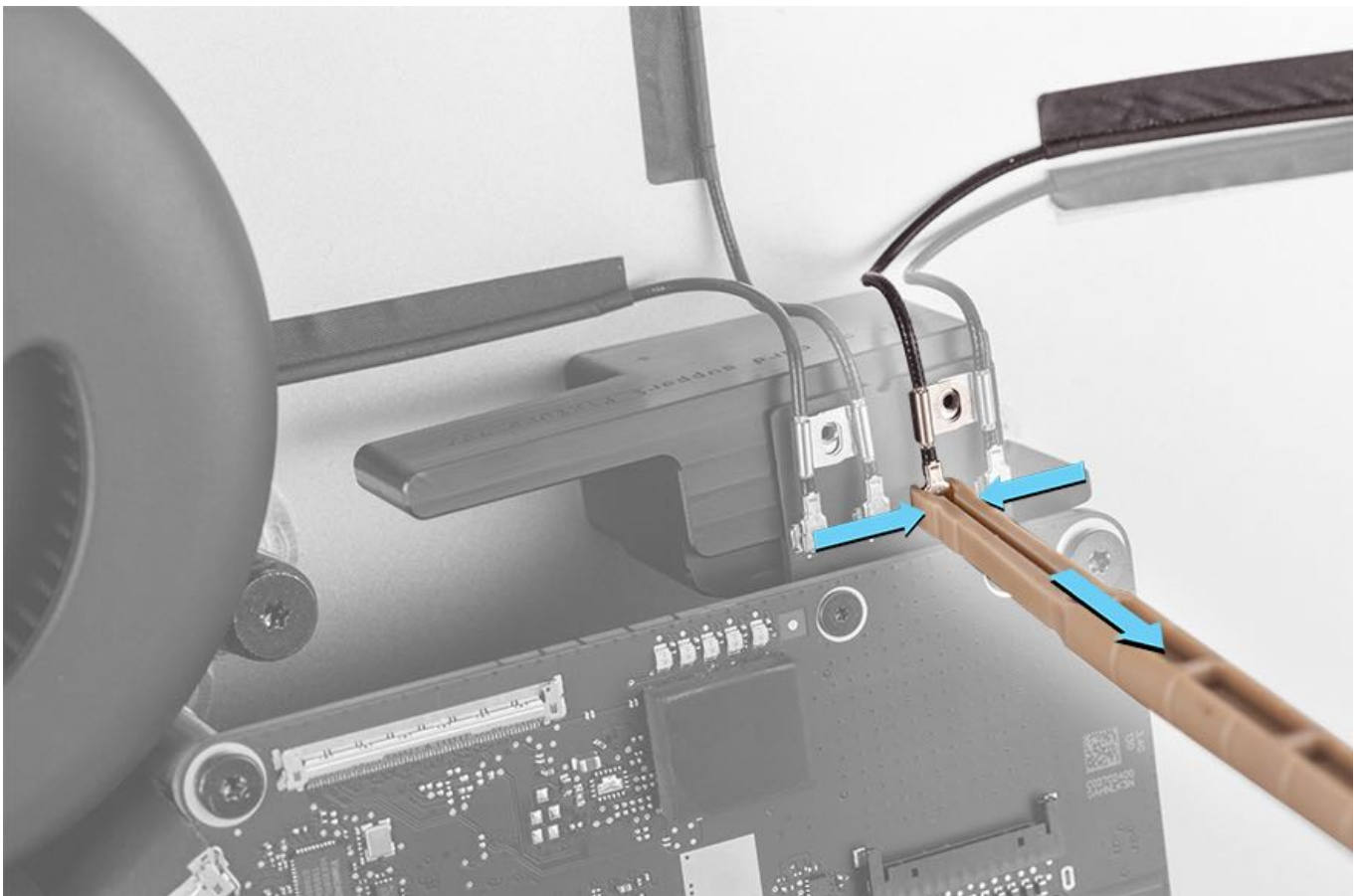
3. Remove the T5 screw from the wireless card.

- T5: 923-01667

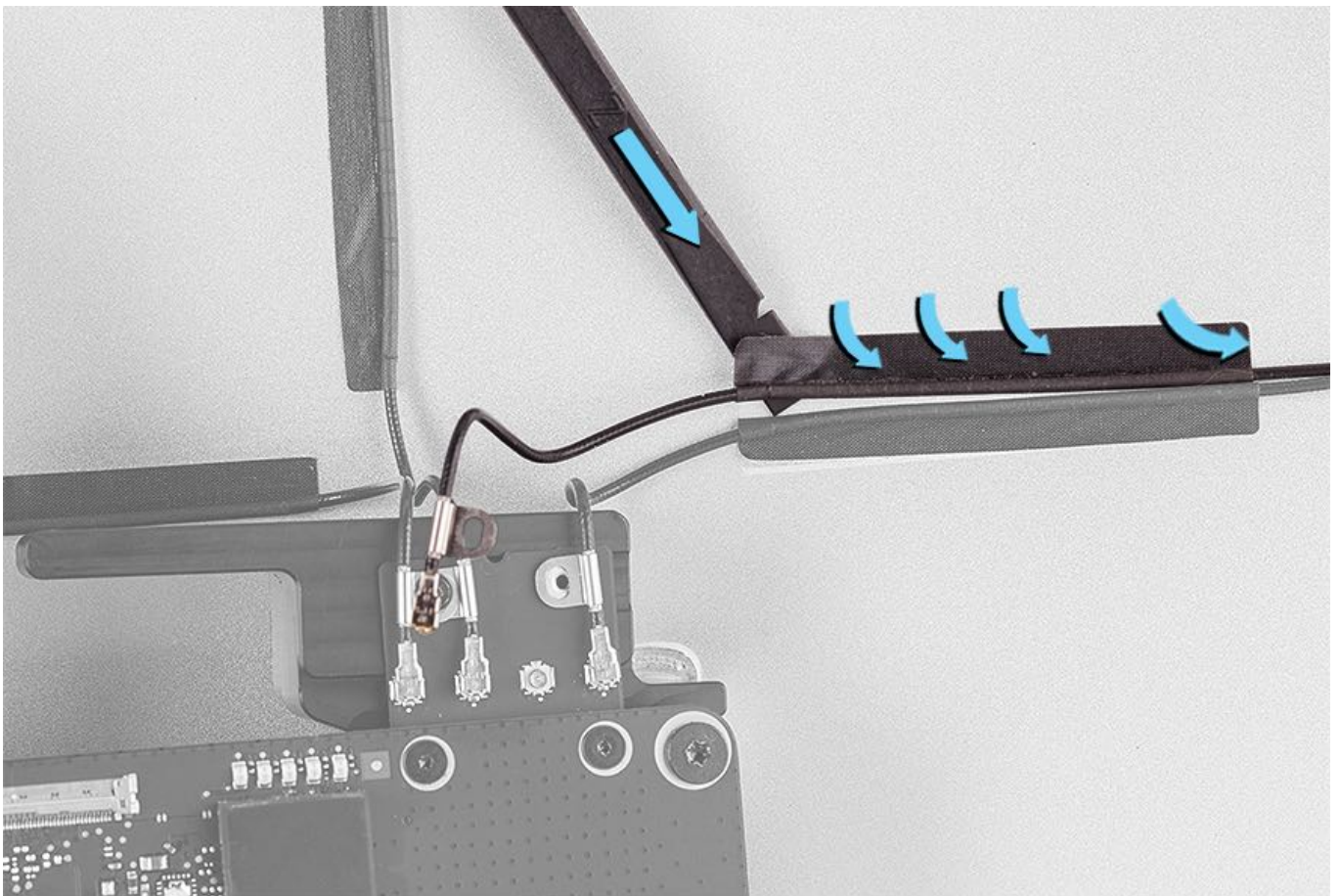


4. Use the antenna tool or ESD-safe tweezers to disconnect the connector from the wireless card.

Note: Avoid using a metal tool that could crimp or damage the cable.



5. Use a black stick or your fingers to gently remove tape from the rear housing.



6. Use a black stick to gently loosen the tape along the airloop gasket (#1).

7. Remove two T4 screws that secure the antenna body to the rear housing (#2).

- T4: 923-0304



8. Remove the mid Wi-Fi antenna from the computer assembly.



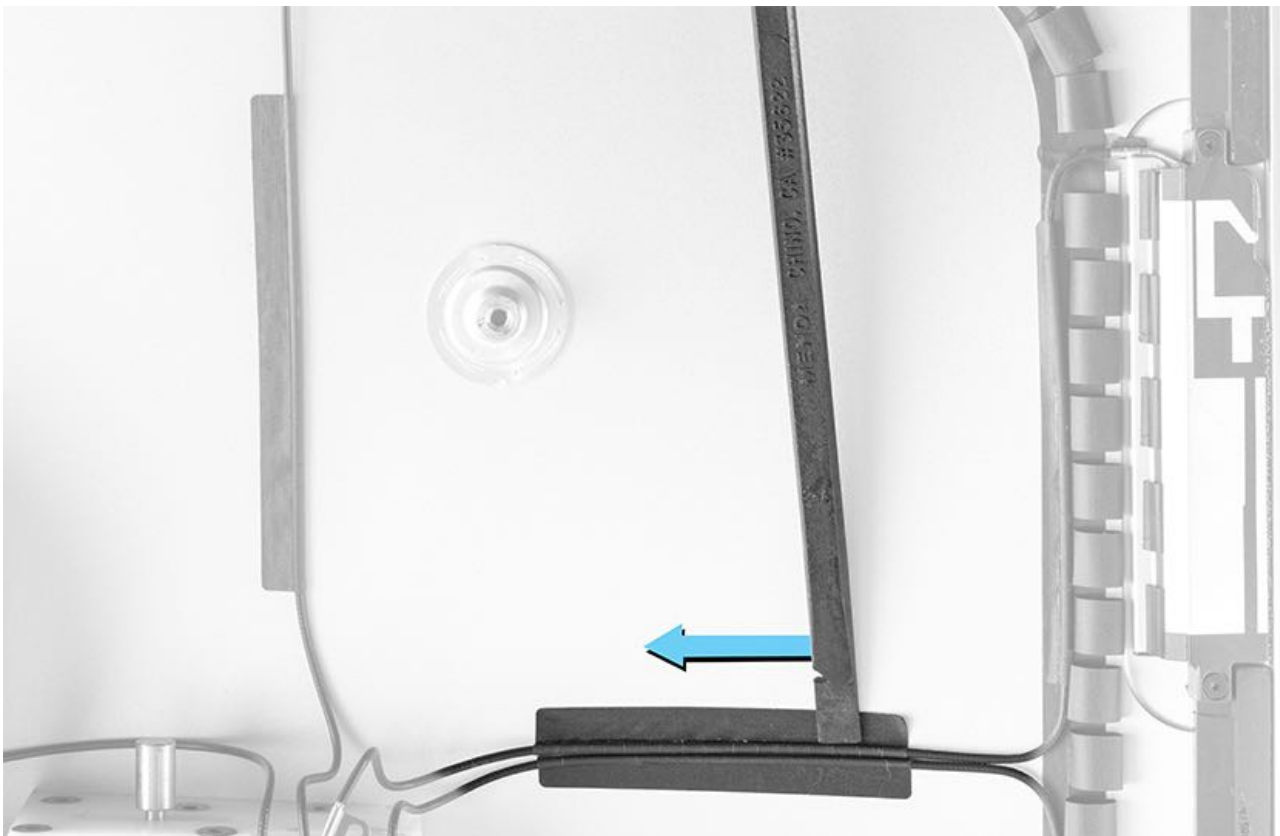
Steps For Reassembly

1. Install two T4 screws to secure the antenna body to the rear housing.

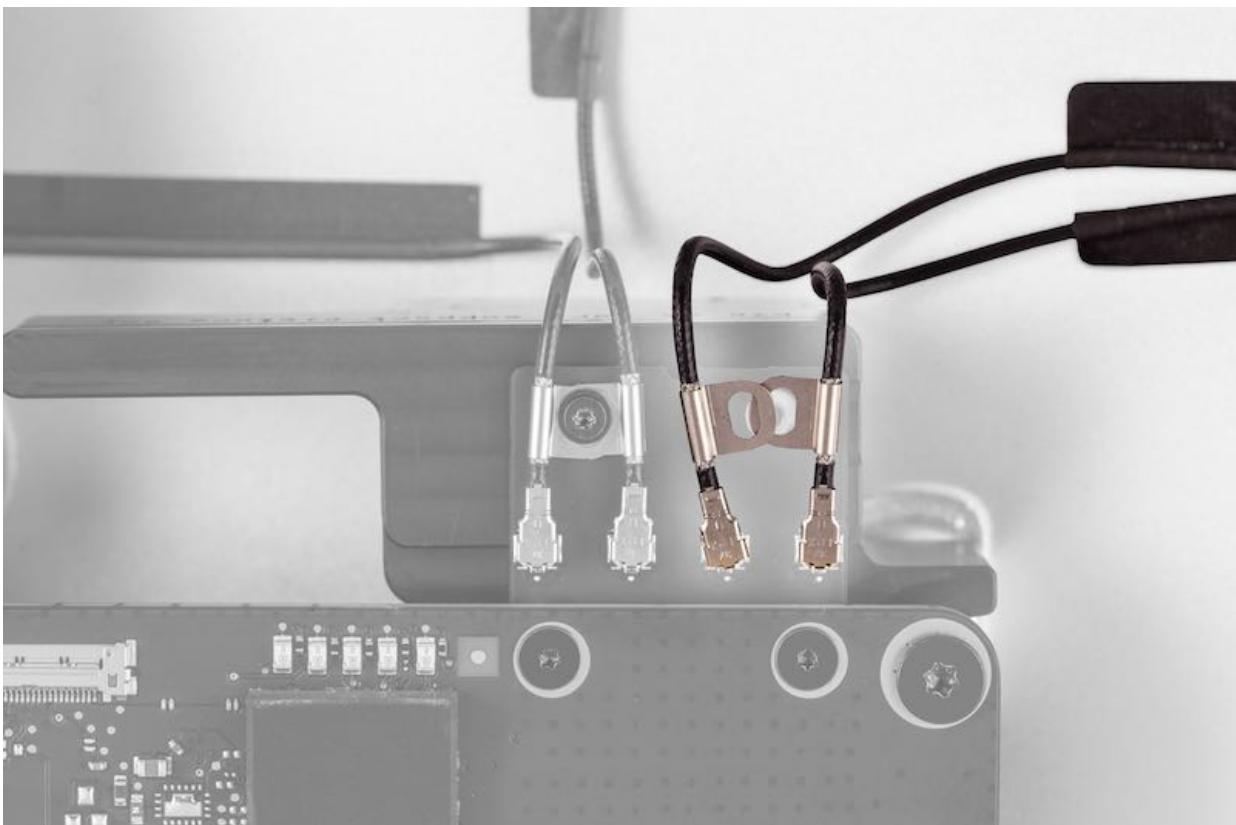
- T4: 923-0304



2. Route the antenna cable to the housing. Use the flat end of a black stick or your fingers to secure the tape.



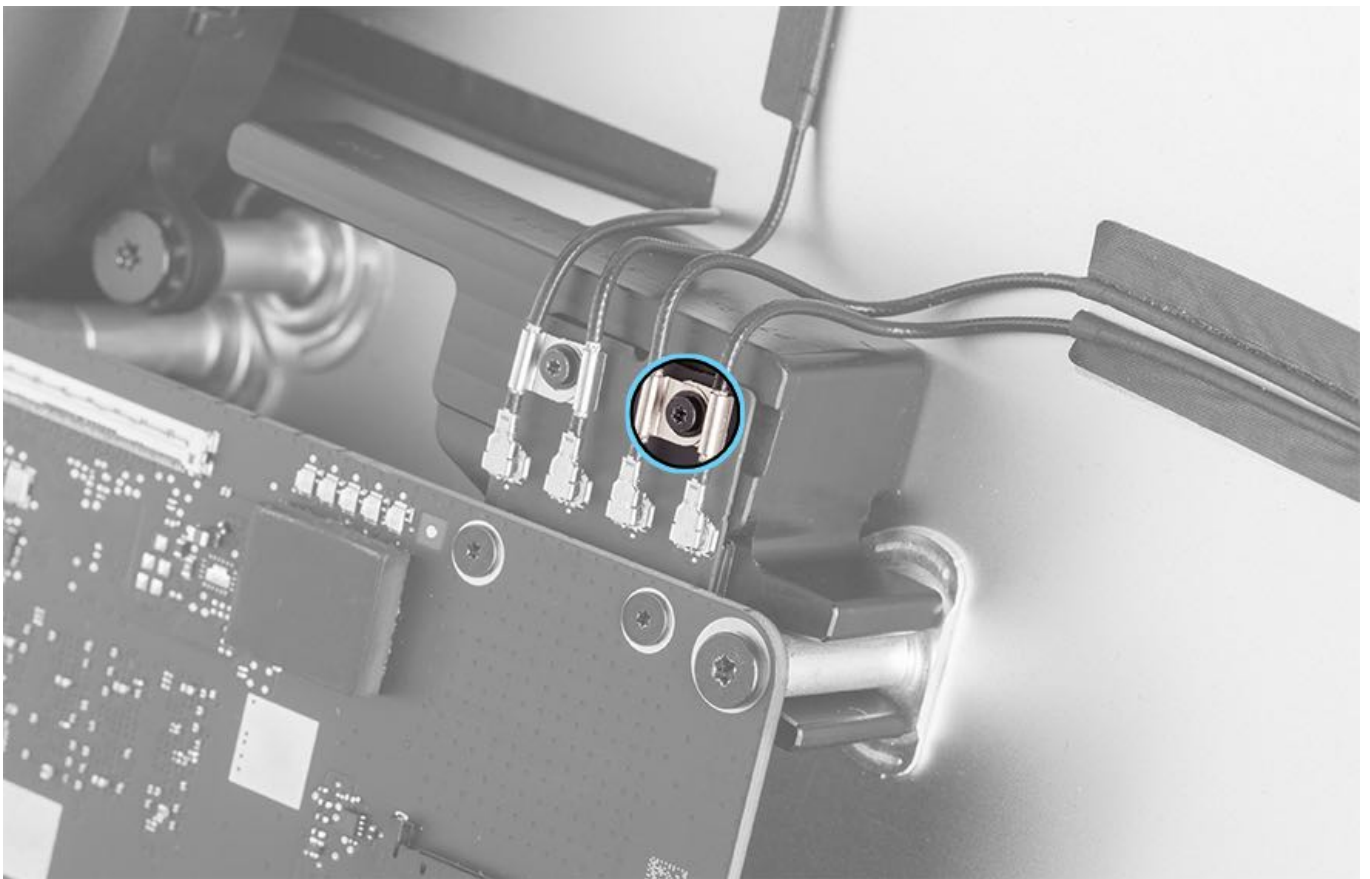
3. Slide the right bracket under the left bracket.



4. Use the antenna tool or ESD-safe tweezers to connect the cables to the wireless card.

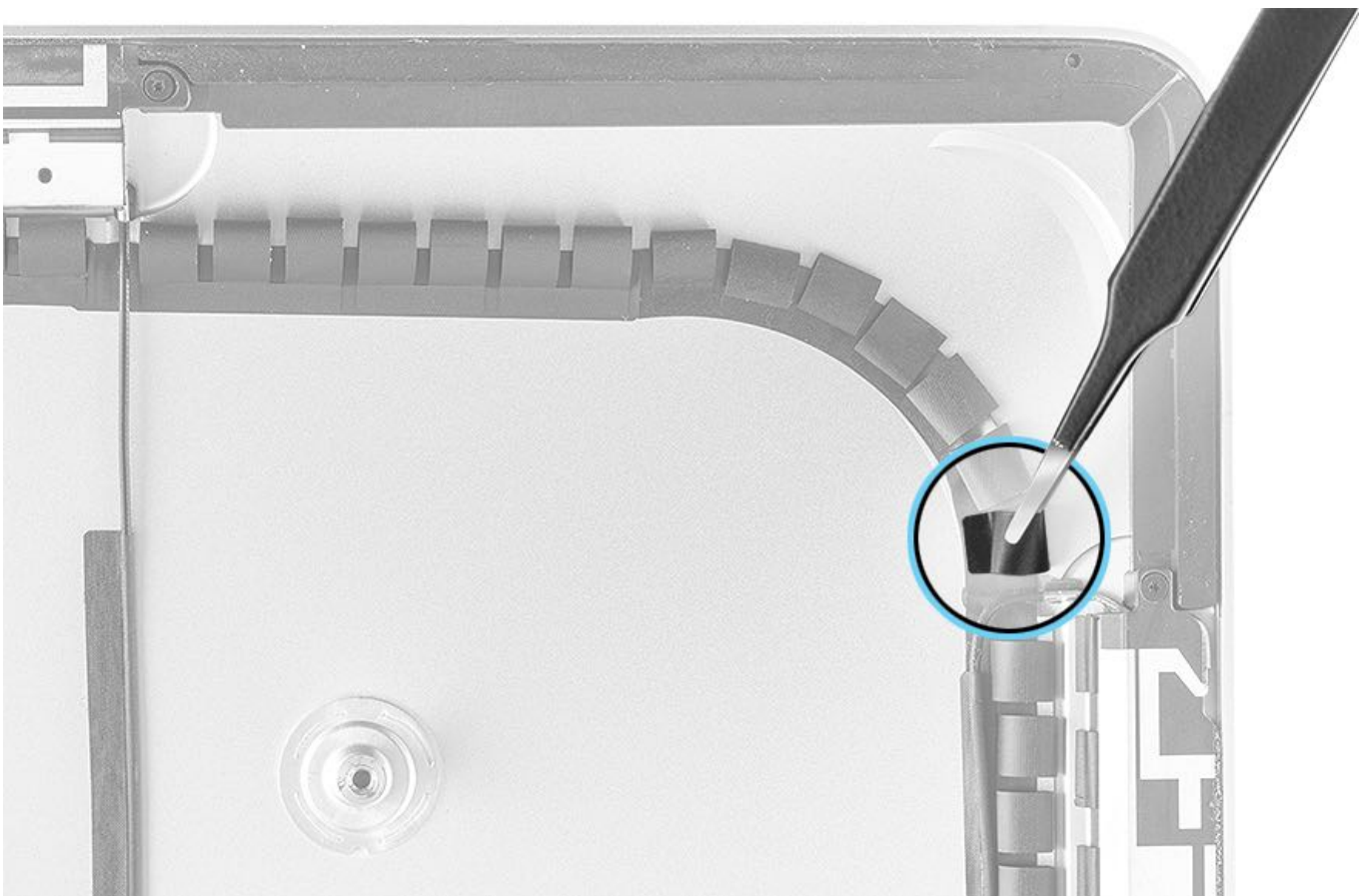
5. Install the T5 screw to the wireless card.

- T5: 923-01667



6. Remove the support tool from the rear housing.

7. Check the airloop gasket and use a black stick or tweezers to open any flattened loops.



8. Reinstall the [right speaker](#).

9. Reinstall the [chin strap](#).

10. Install new [display panel VHB strips](#).

11. Reinstall the [display panel](#).

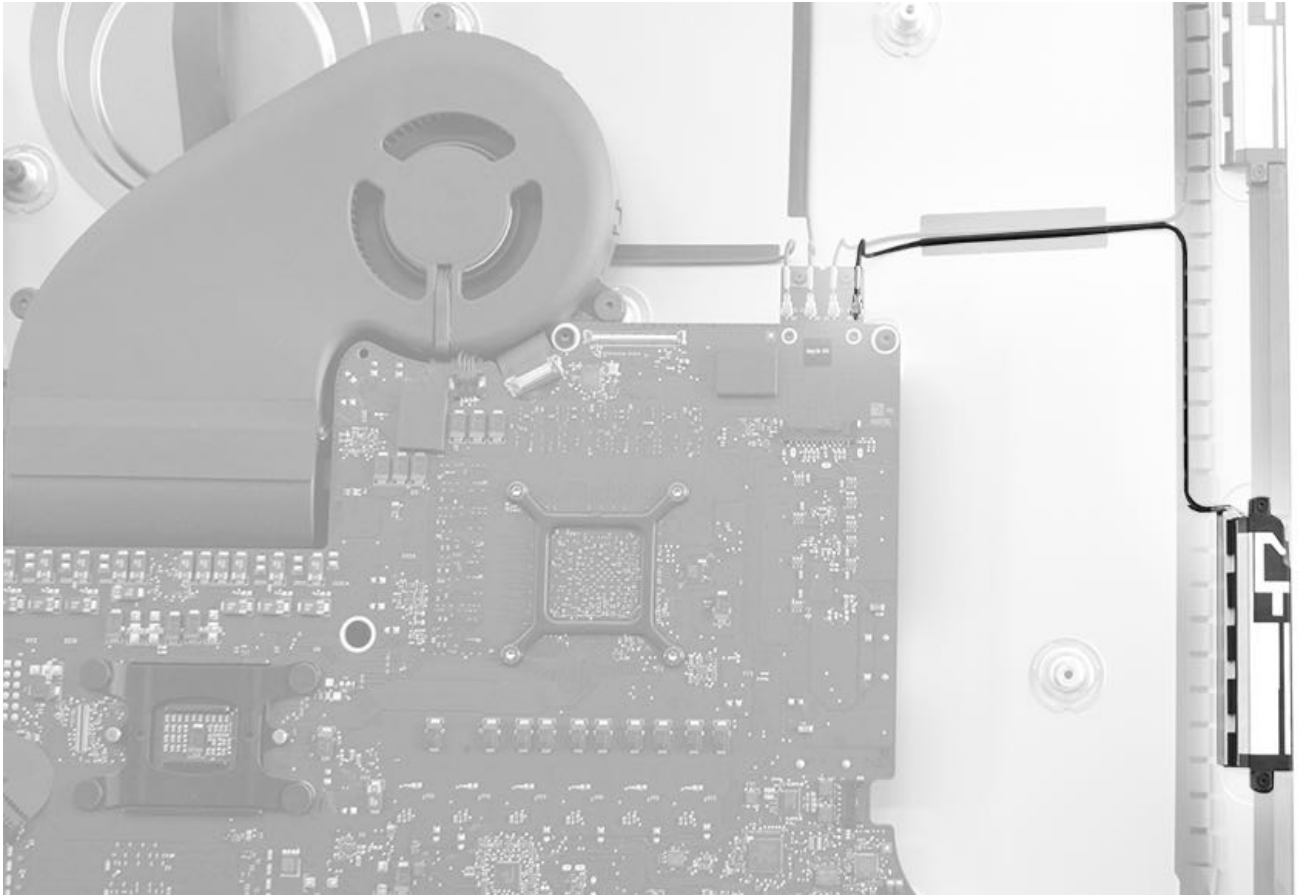
Lower Wi-Fi Antenna

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

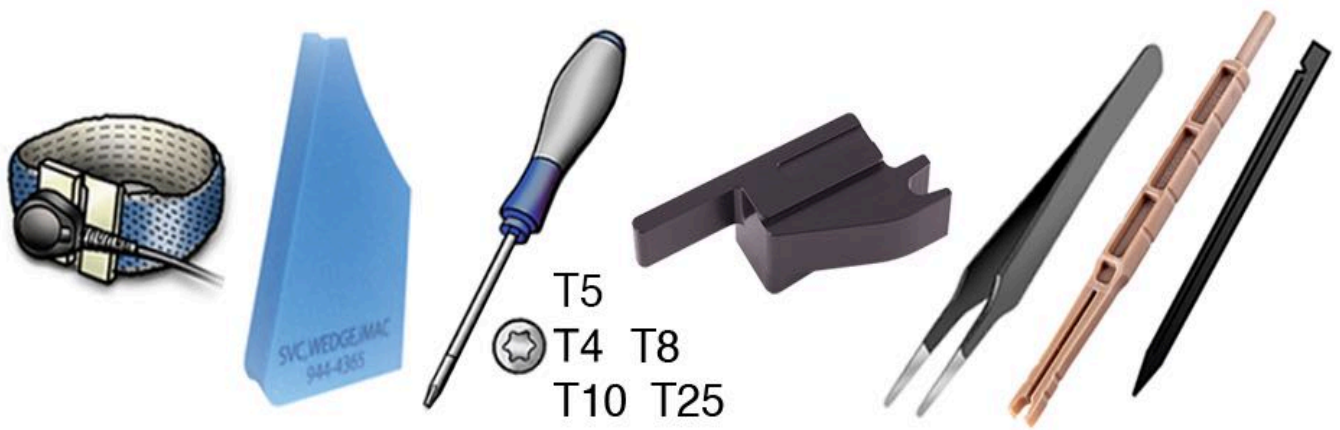
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



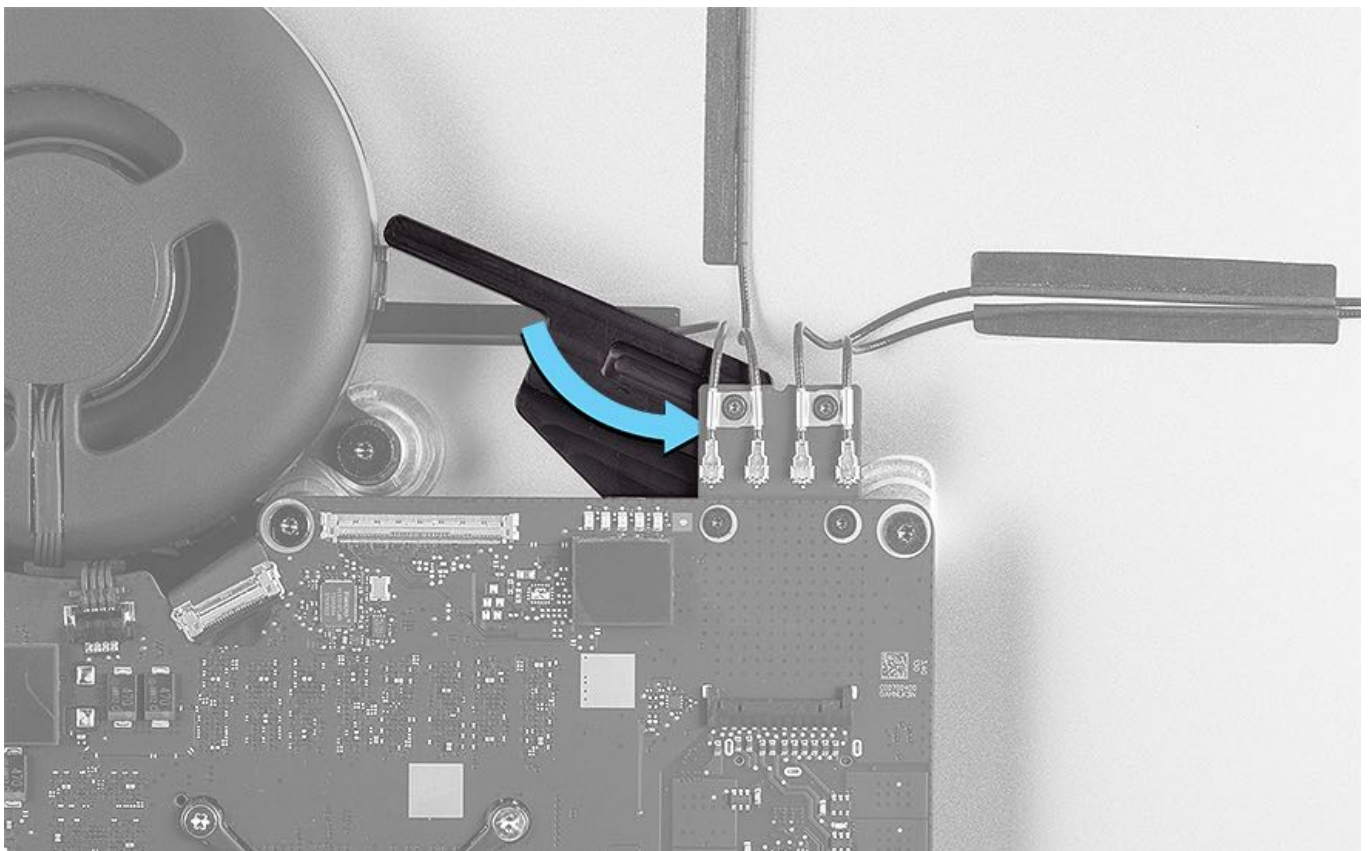
Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- Torx T5 screwdriver (magnetized)
- Torx T4 screwdriver (magnetized)
- Wireless card support tool (923-01807)
- Antenna tool or ESD-safe tweezers
- Black stick

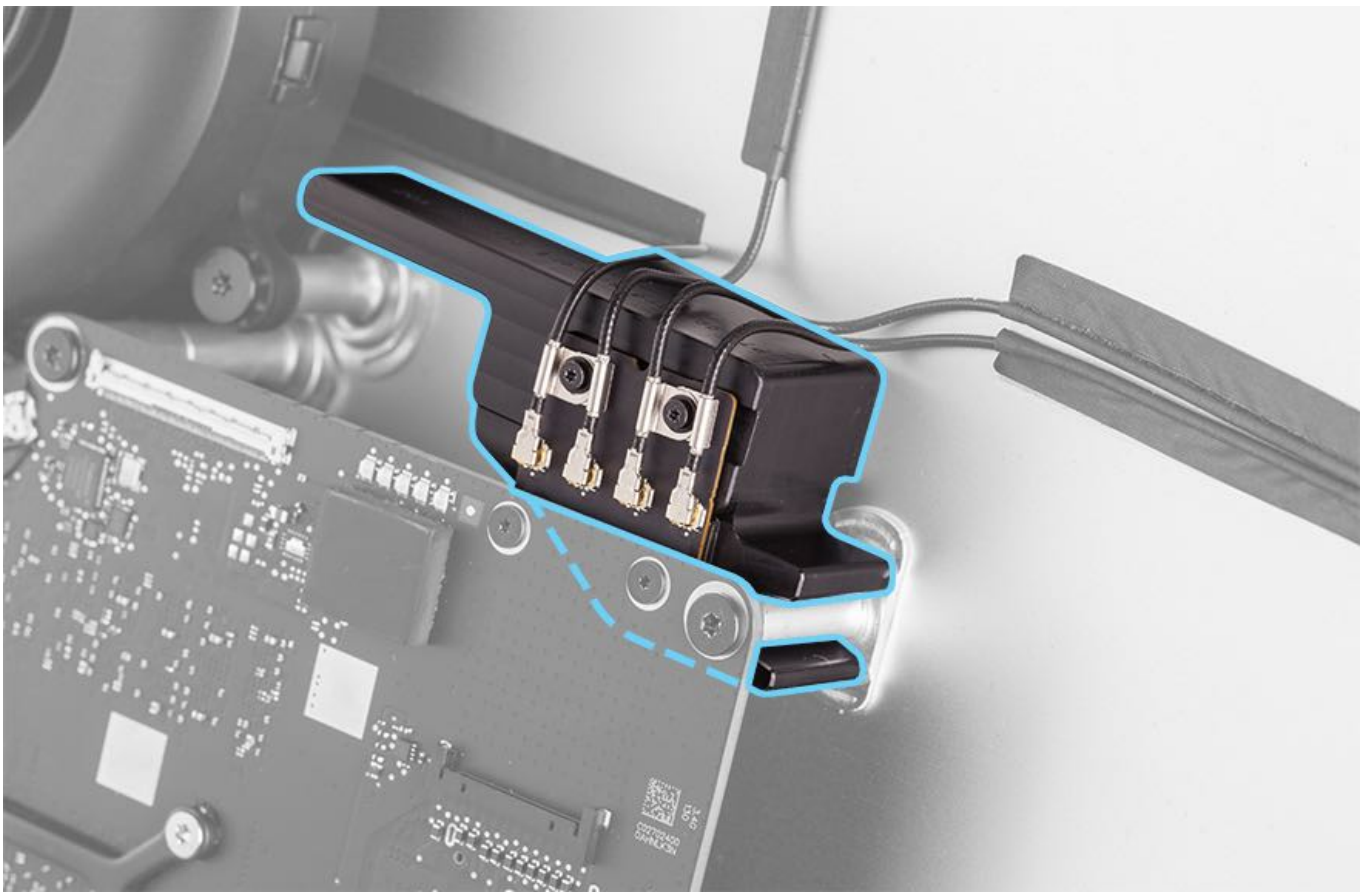


Steps For Removal

1. To protect the wireless card, slide the wireless card support tool into place between the rear housing and the wireless card.

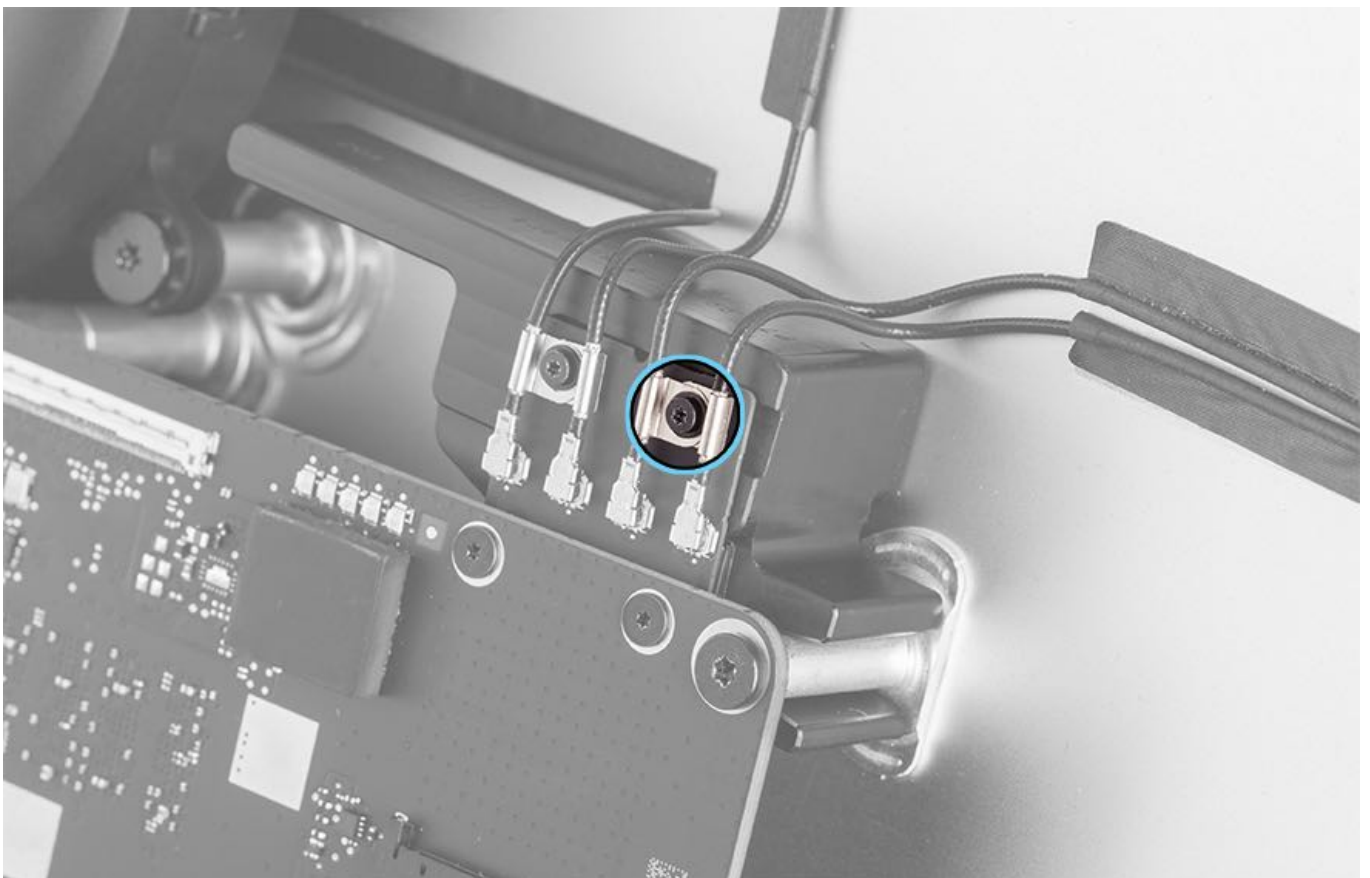


2. Keep the support tool in position while removing or replacing screws and disconnecting or reconnecting antenna cables.



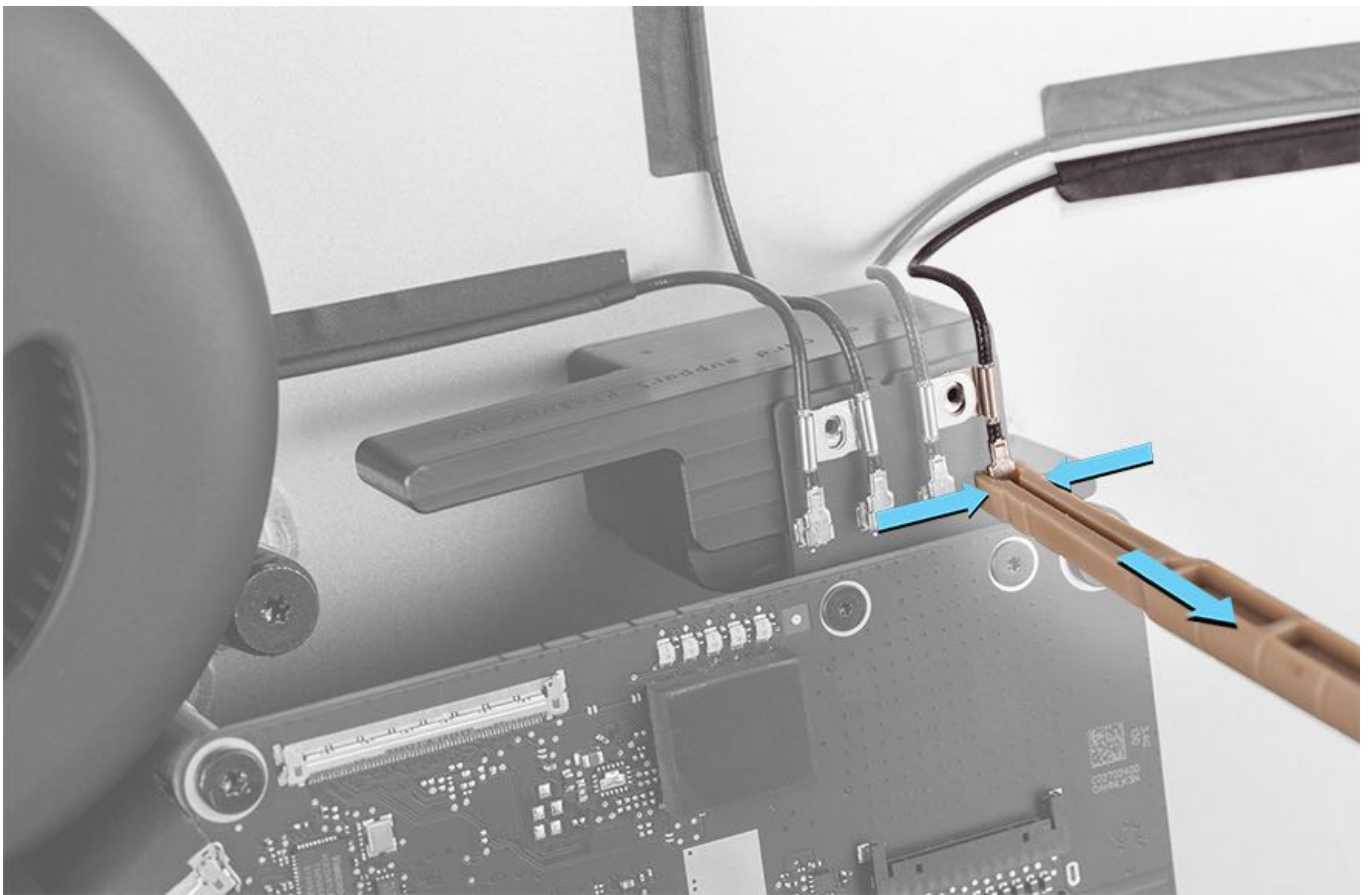
3. Remove the T5 screw from the wireless card.

- T5: 923-01667

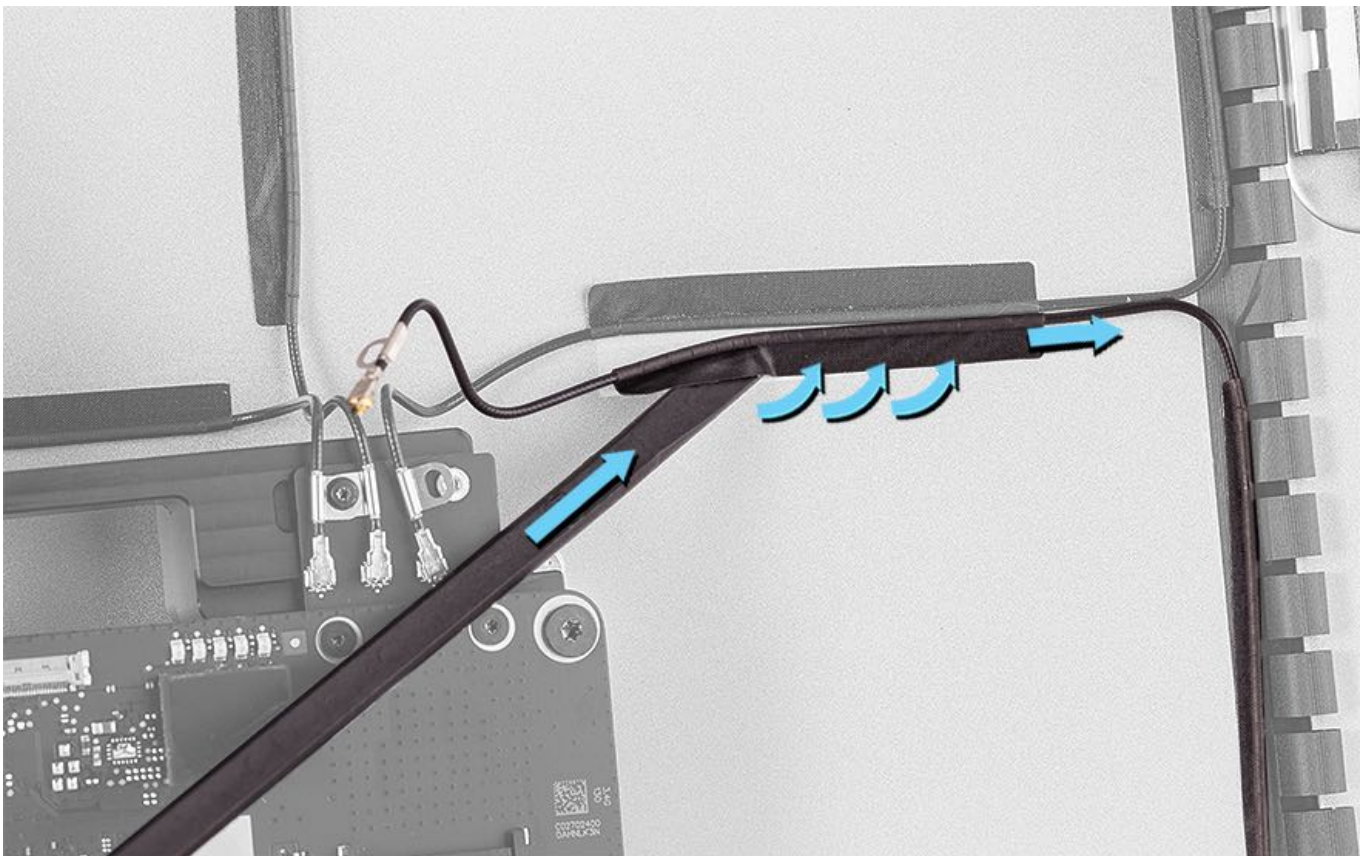


4. Use the antenna tool or ESD-safe tweezers to disconnect the connector from the wireless card.

Note: Avoid using a metal tool that could crimp or damage the cable.

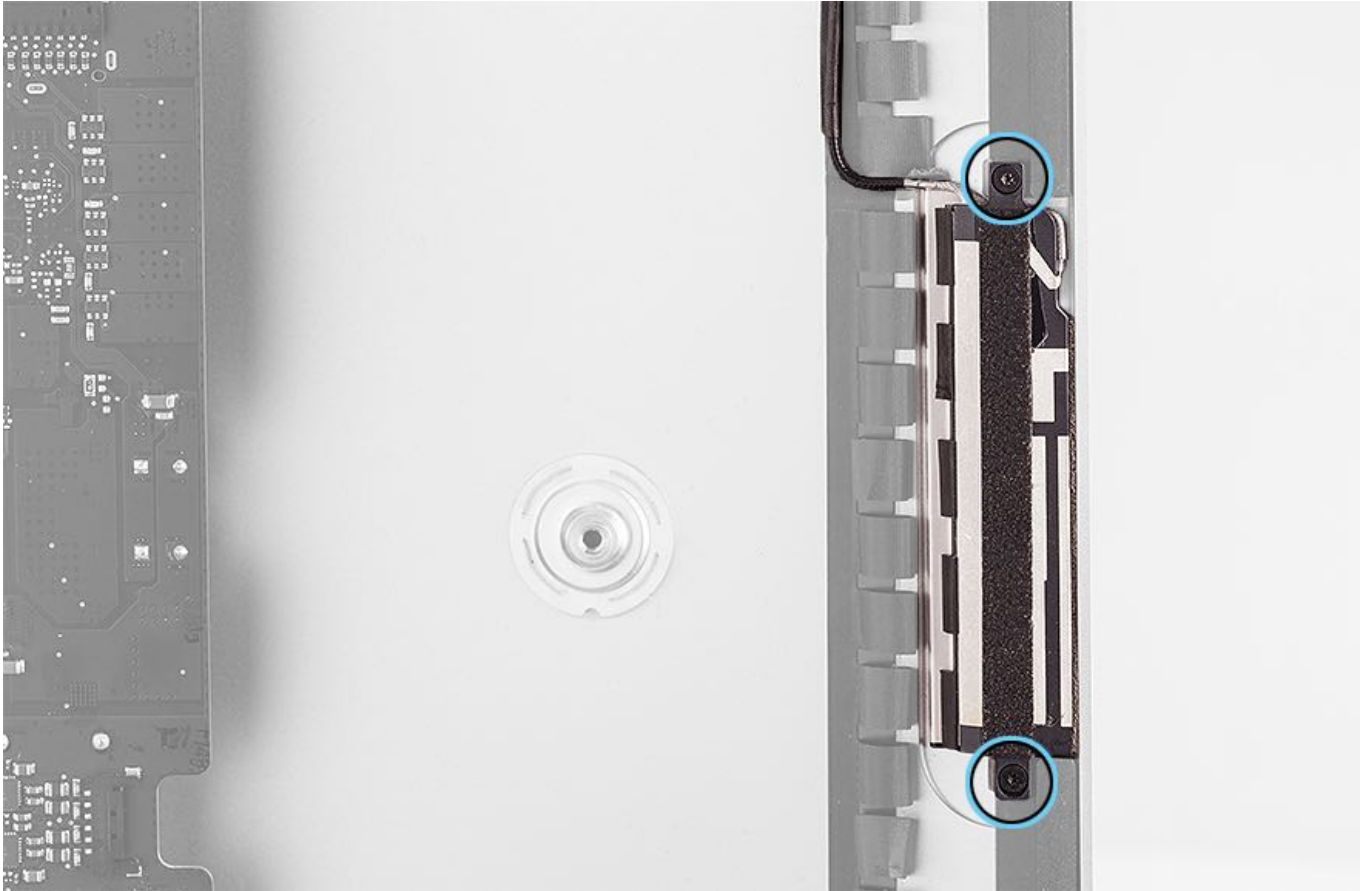


5. Use a black stick or your fingers to gently remove the tape from the rear housing.



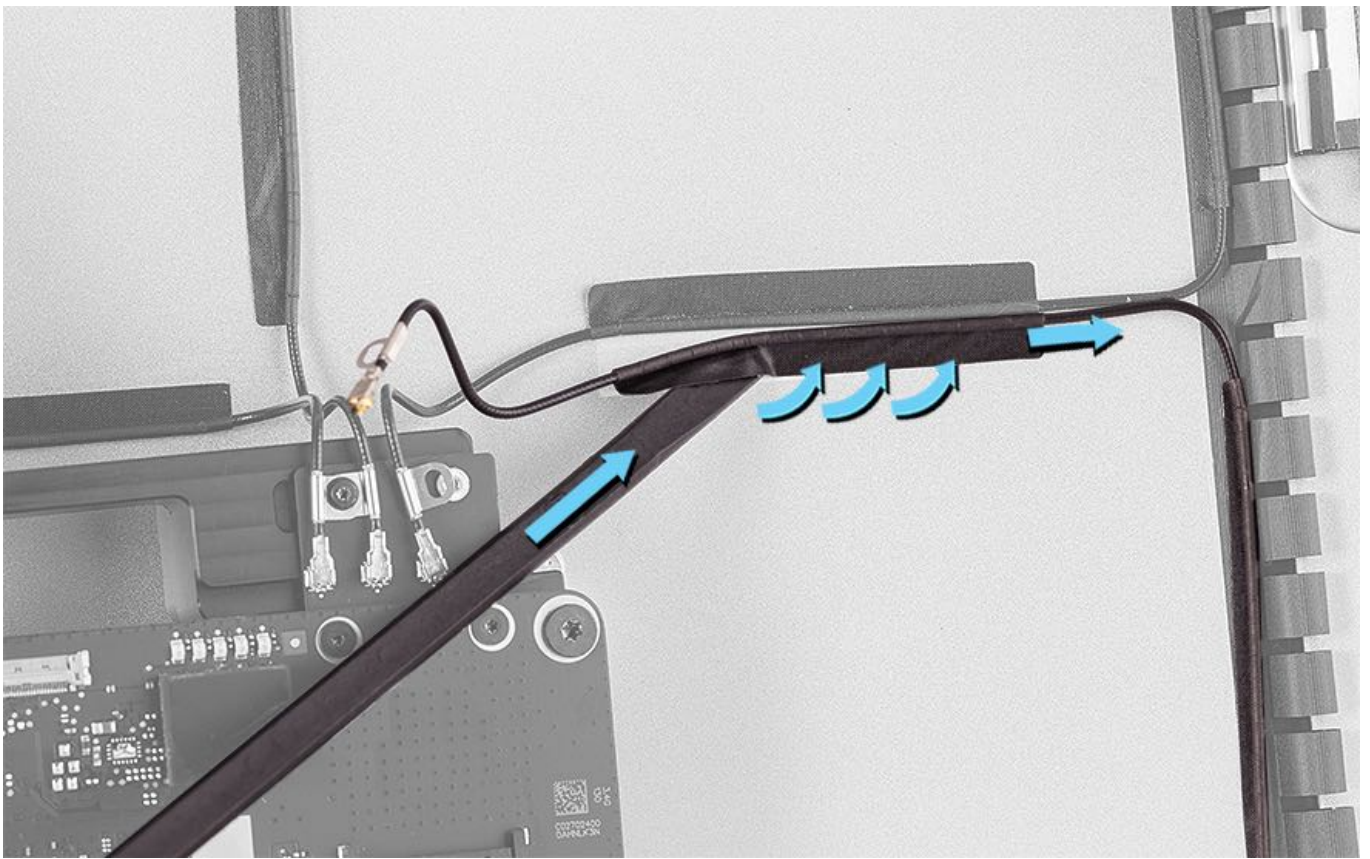
6. Remove two T4 screws that secure the lower antenna body to the rear housing. Remove the lower Wi-Fi antenna from the rear housing.

- T4: 923-0304

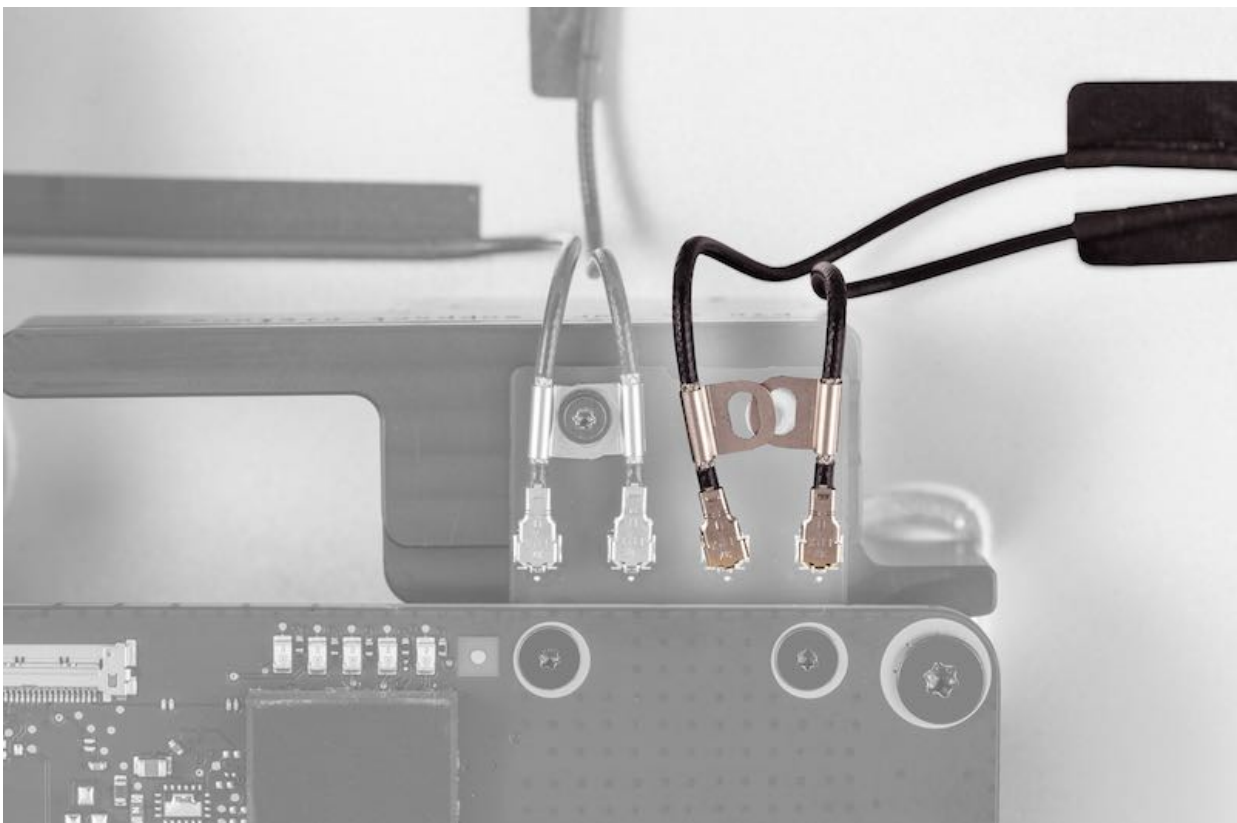


Steps For Reassembly

1. Install two T4 screws to secure the antenna to the rear housing.
 - T4: 923-0304
2. Route the antenna cable tape and secure to the housing.



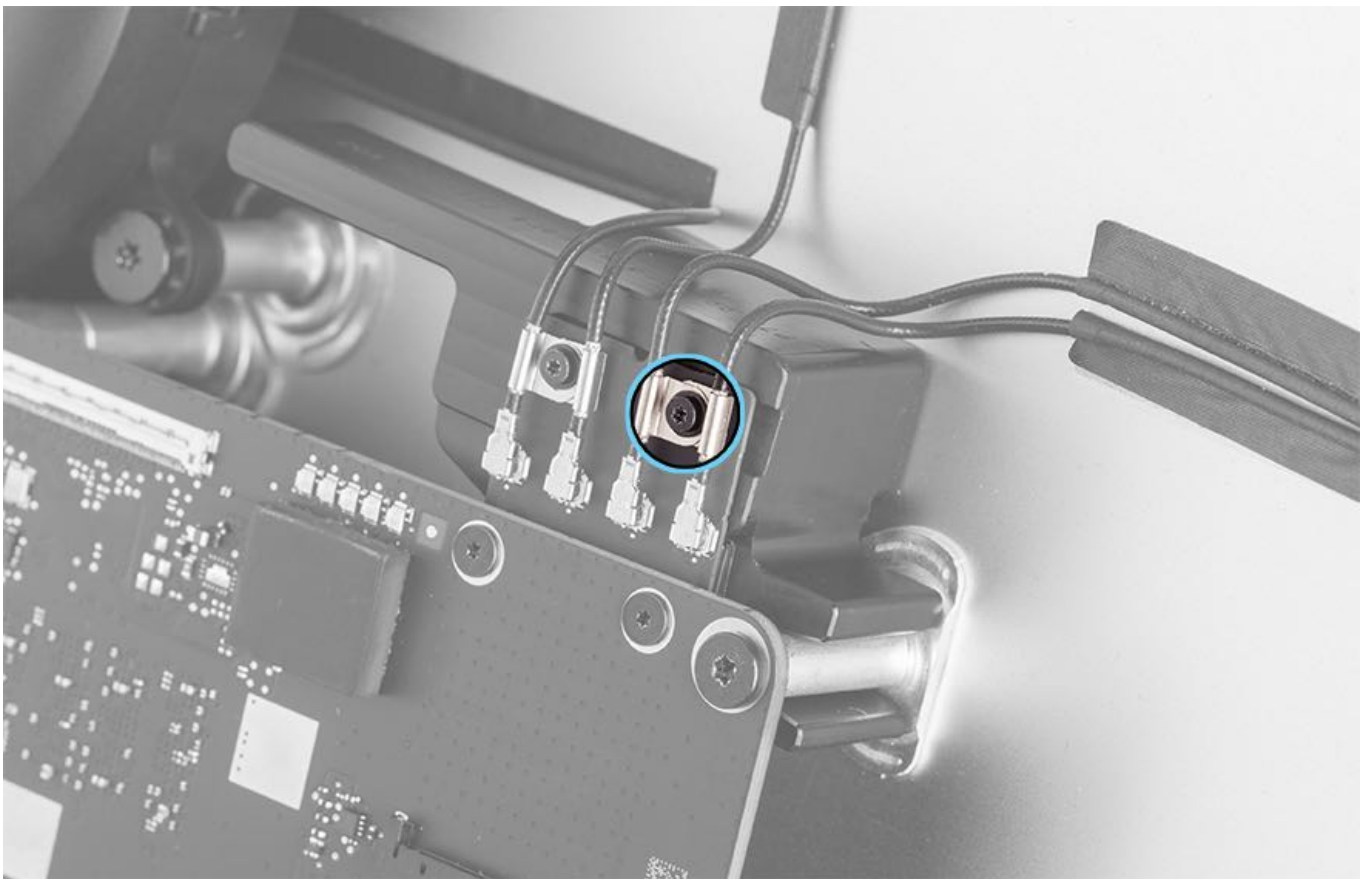
3. Slide the right bracket under the left bracket.



4. Use the antenna tool or ESD-safe tweezers to connect the cable to the wireless card.

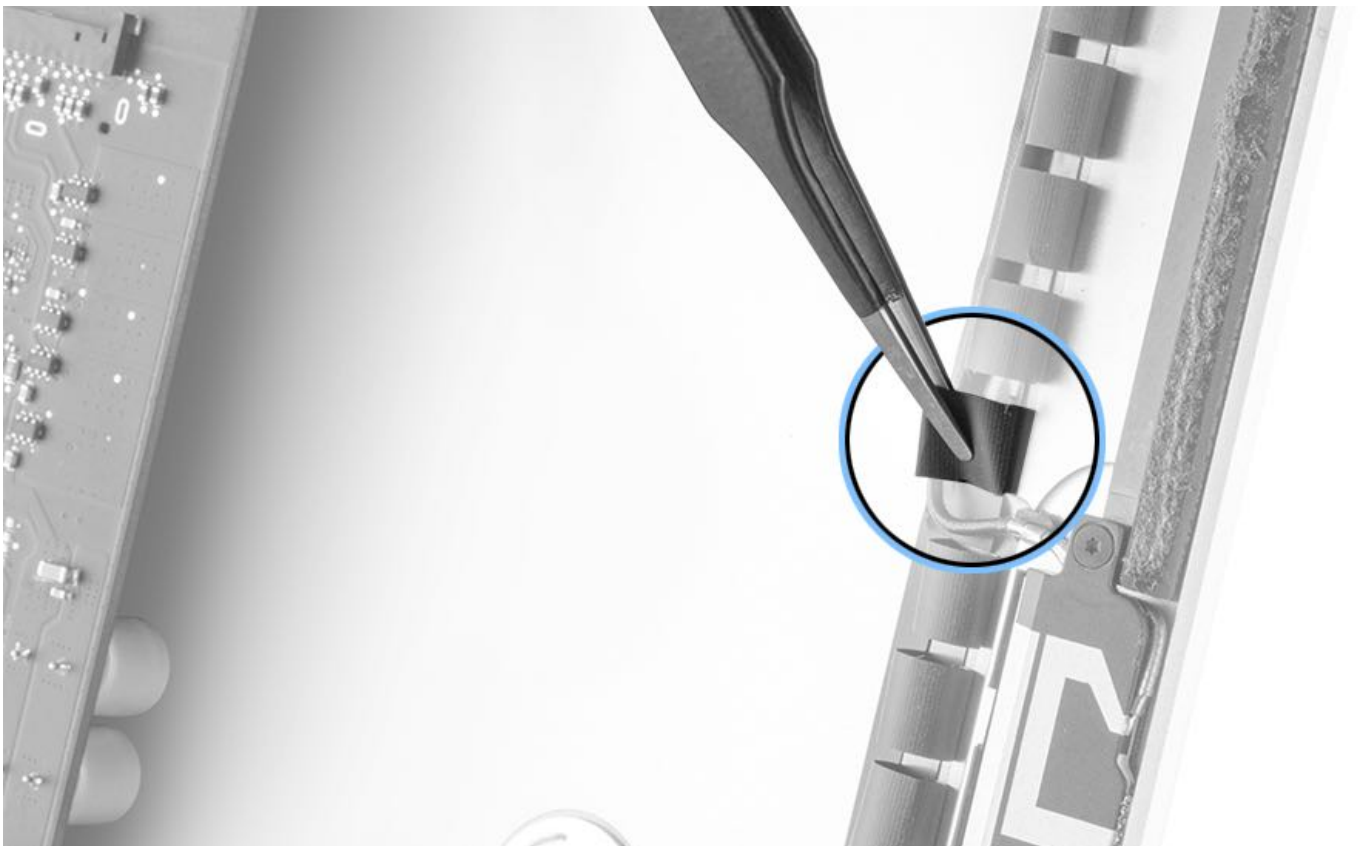
5. Install the T5 screw to the wireless card.

- T5: 923-01667



6. Remove the support tool from the rear housing.

7. Check the airloop gasket and use a black stick or tweezers to open any flattened loops.



8. Reinstall the [right speaker](#).

9. Reinstall the [chin strap](#).

10. Install new [display panel VHB strips](#).

11. Reinstall the [display panel](#).

Power Supply

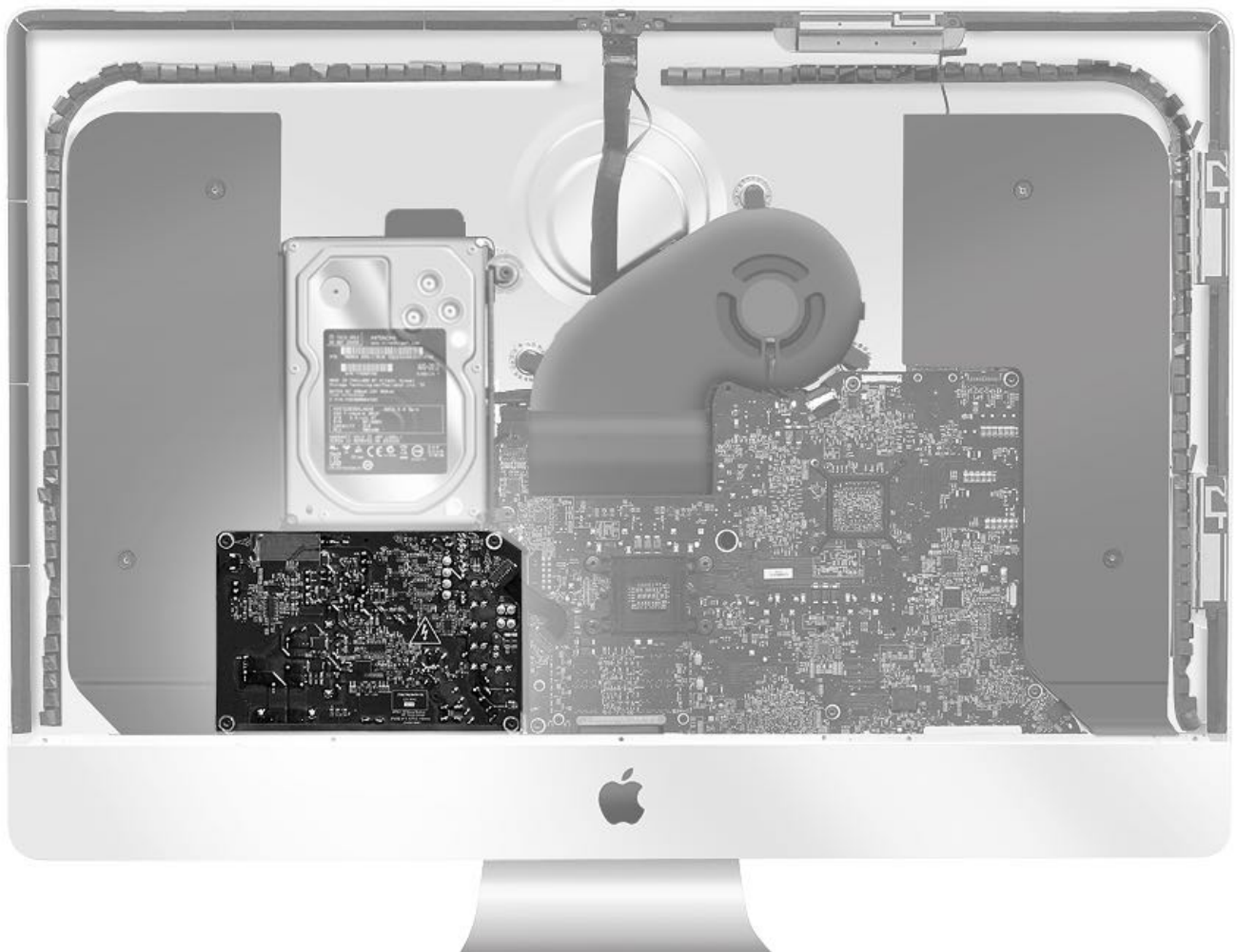
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV246: Power Supply Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Left speaker](#)
- [Hard drive](#)



Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)
- Service wedge (iMac)



Steps For Removal



Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Warning: iMac (Late 2012 and later) models require two protective covers (923-0189) when performing live adjustments; one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in the following articles:

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch\): Safety](#)

Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

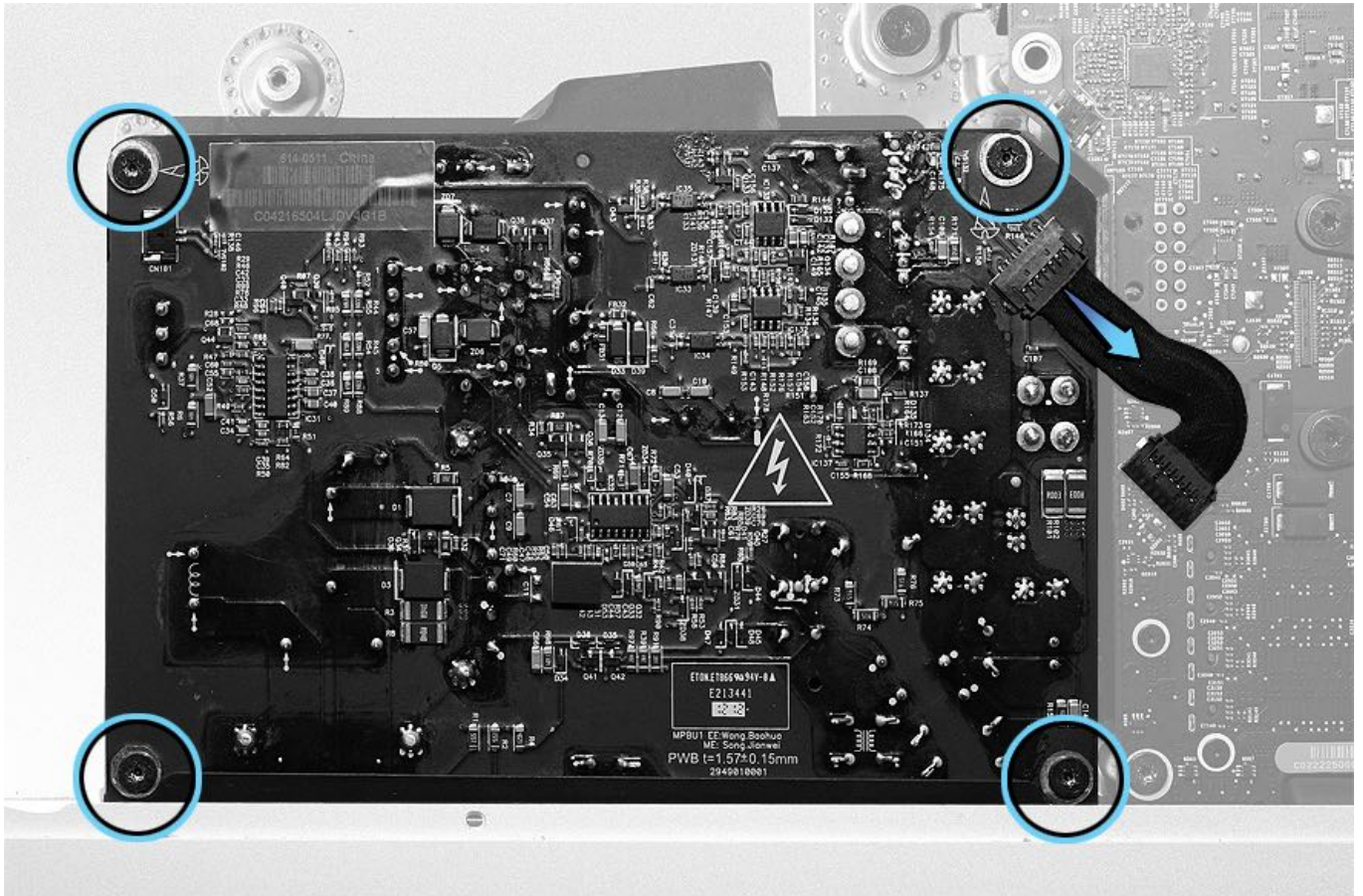
- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other nonmetal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

1. Disconnect the power signal cable from the power supply, then remove four T8 screws.

- T8: 923-0396, 23 mm, two along top edge



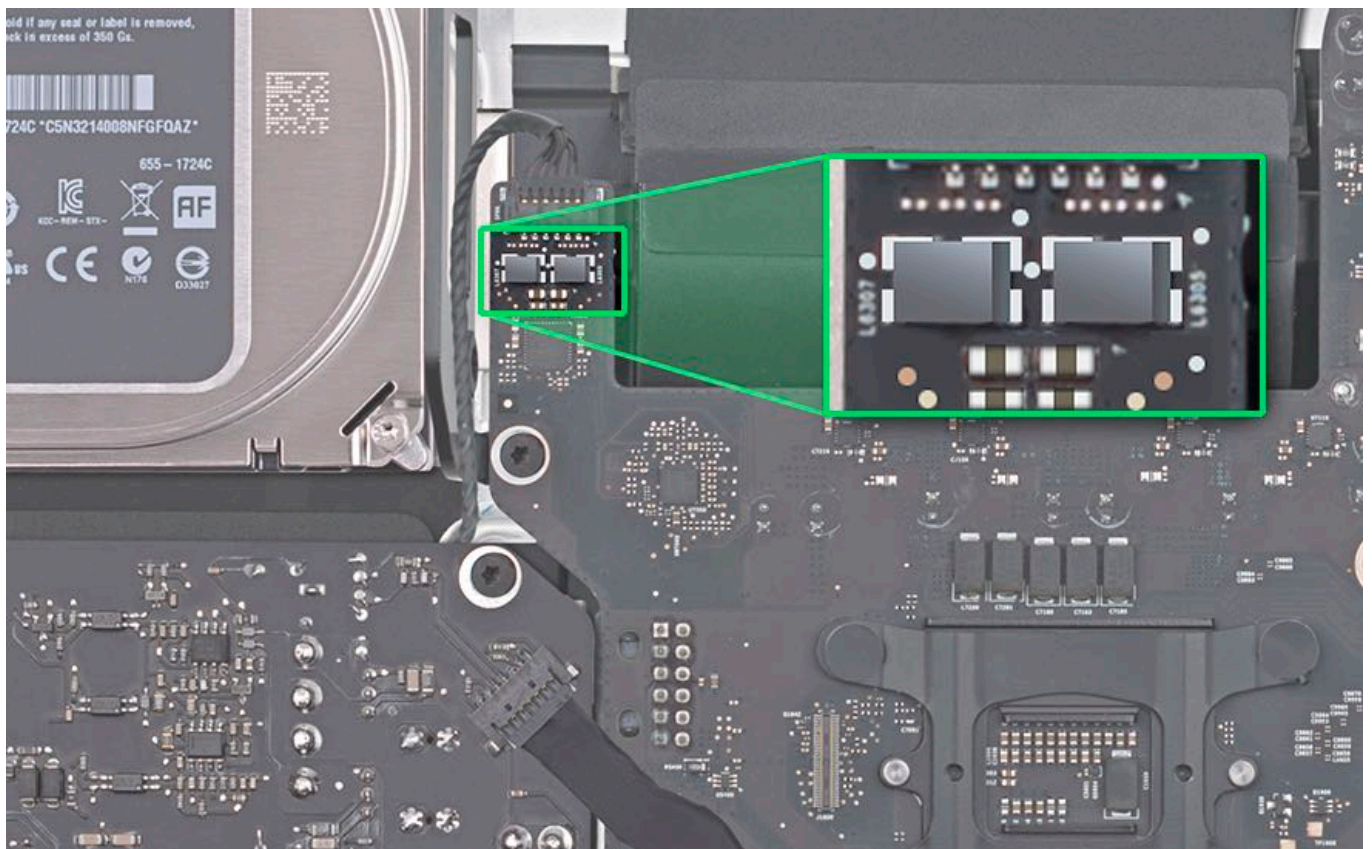
- T8: 923-0331, 7.05 mm, two along bottom edge near chin



Caution: Be careful not rotate the power supply toward the left speaker connector on the logic board as it could make contact with and damage the inductors on the logic board.

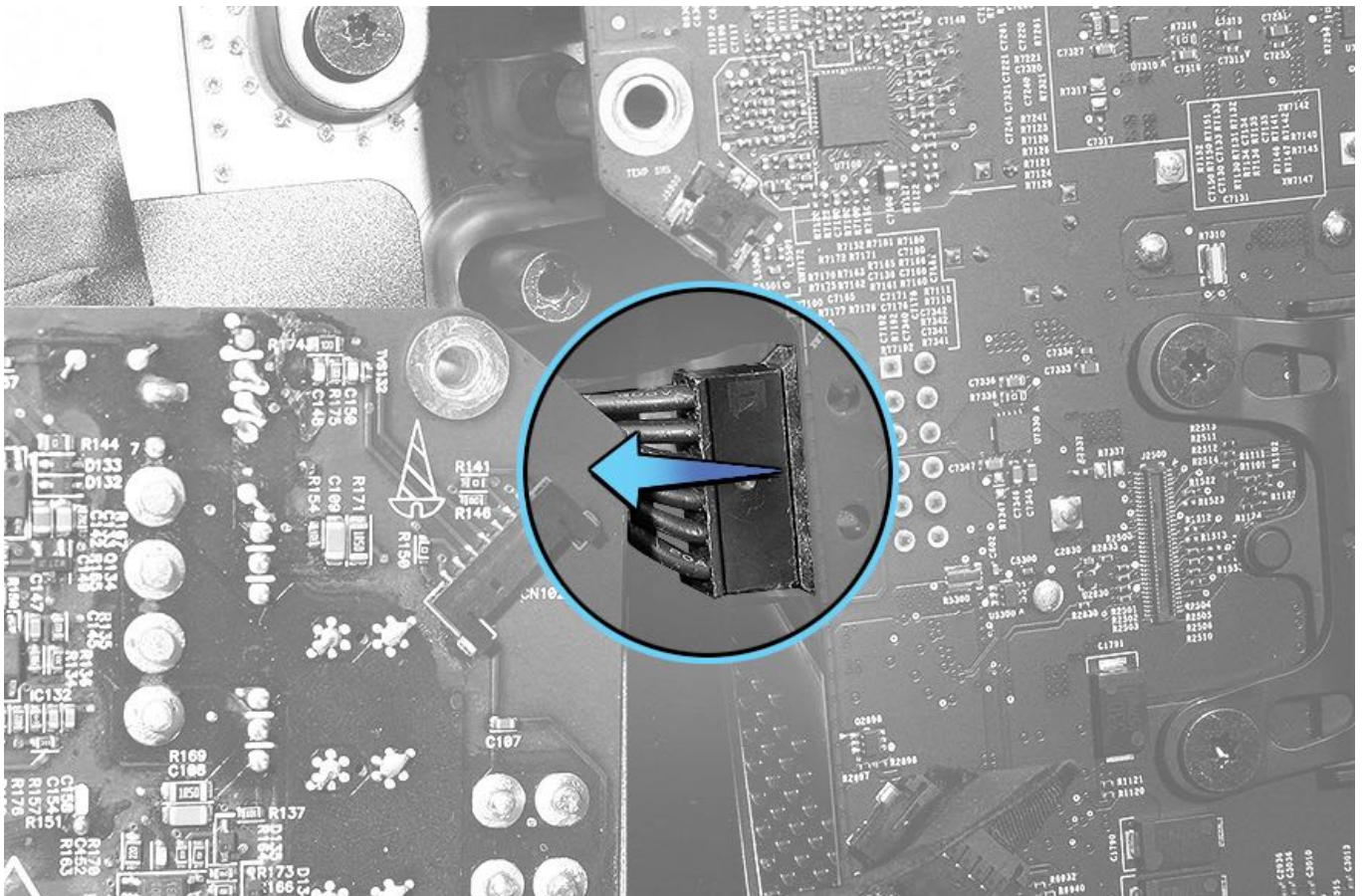
2. Remove the power supply as instructed in step 3.

iMac logic board inductors



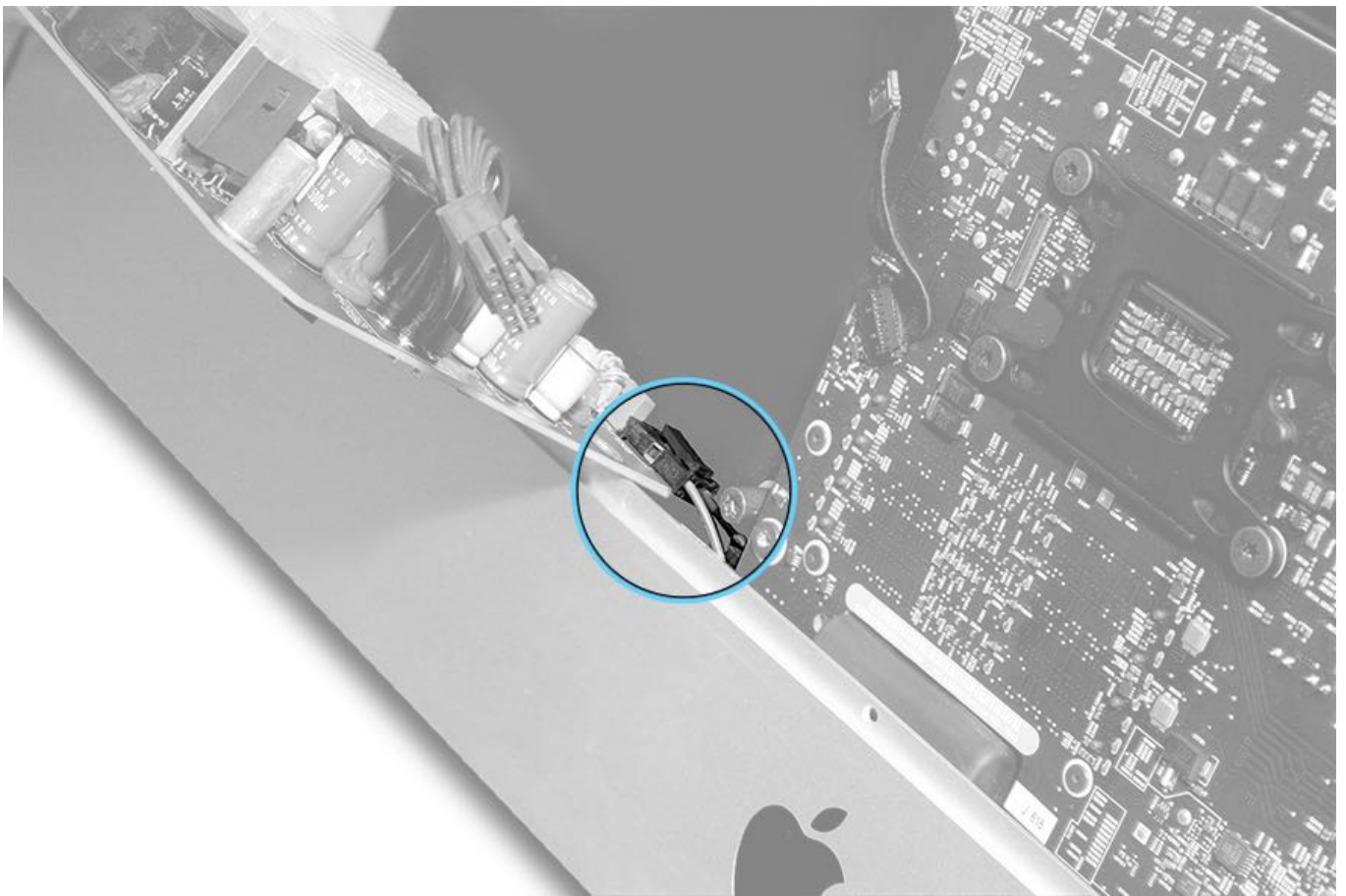
3. Slide the power supply slightly to the left. Reach underneath and disconnect the DC power cable. Pinch the cable connector to release and pull the cable toward the left speaker.

Note: This is a tight connection. Pinch and pull **hard** on the connector, not the cable. Use a black stick (on the underside of the power supply connector) to help release the latch on the connector.



4. Tilt the power supply slightly to disconnect the AC power cable. Pinch and pull the connector to the right.

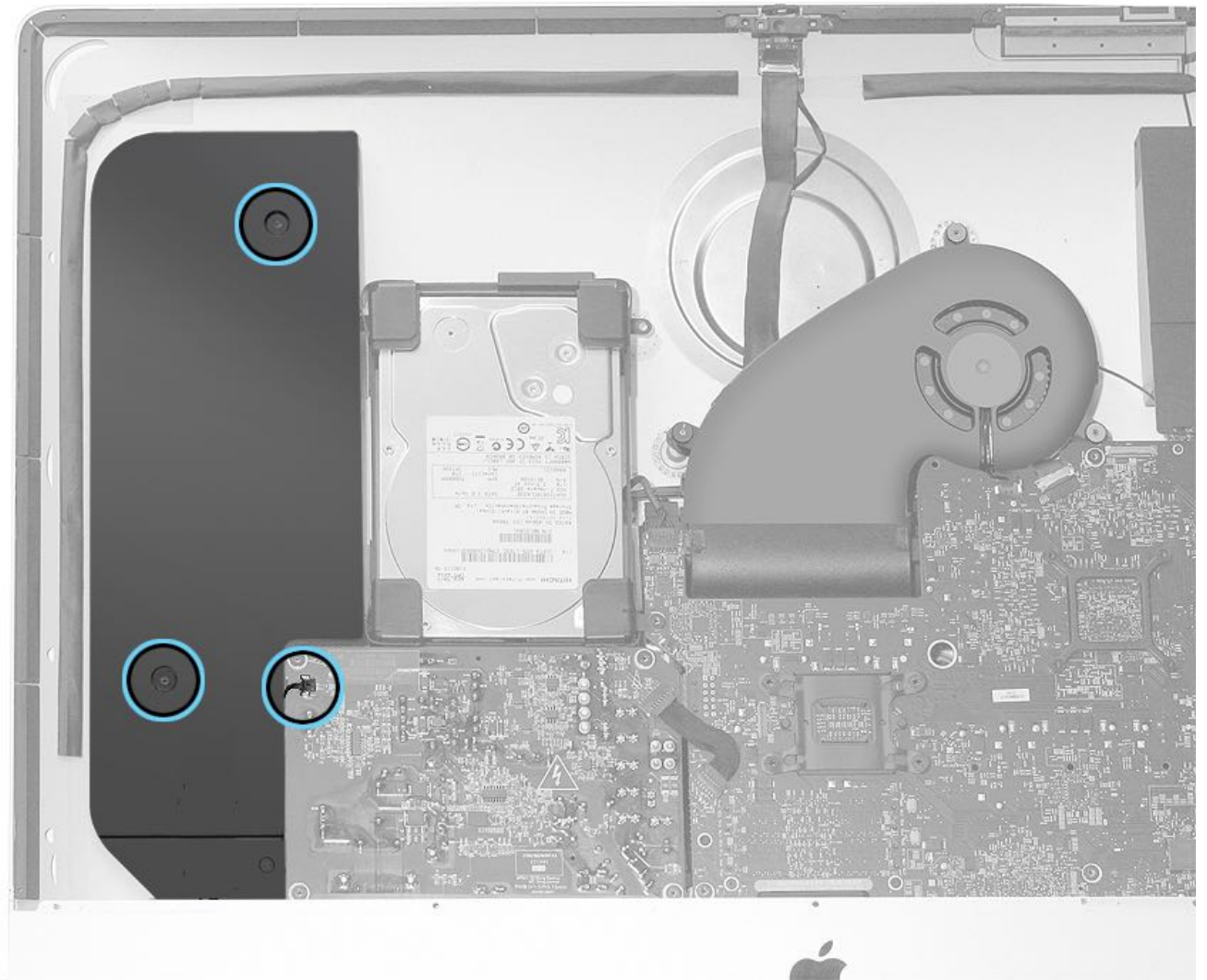
5. Lift the power supply out of the rear housing.



Steps For Reassembly

1. Lower the power supply into the rear housing and connect the AC cable.
2. Connect the DC power cable to the logic board. Check that the cable is securely connected.
3. Reinstall four T8 power supply screws (replace the two long screws at the top **first**, then the two shorter screws at the bottom, near the chin).
4. Connect the power signal cable to the power supply and logic board.
5. Reinstall the [hard drive](#).
6. Reinstall the [left speaker](#).

Note: Do not forget to connect the power-on button cable to the power supply.



7. Reinstall the [chin strap](#).
8. Install new [display panel VHB strips](#).
9. Reinstall the [display panel](#).

Power Supply Signal Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

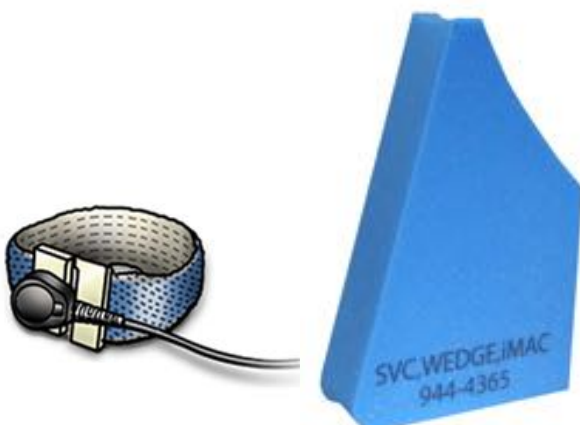
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



Tools

- ESD wrist strap and mat
- Service wedge (iMac)



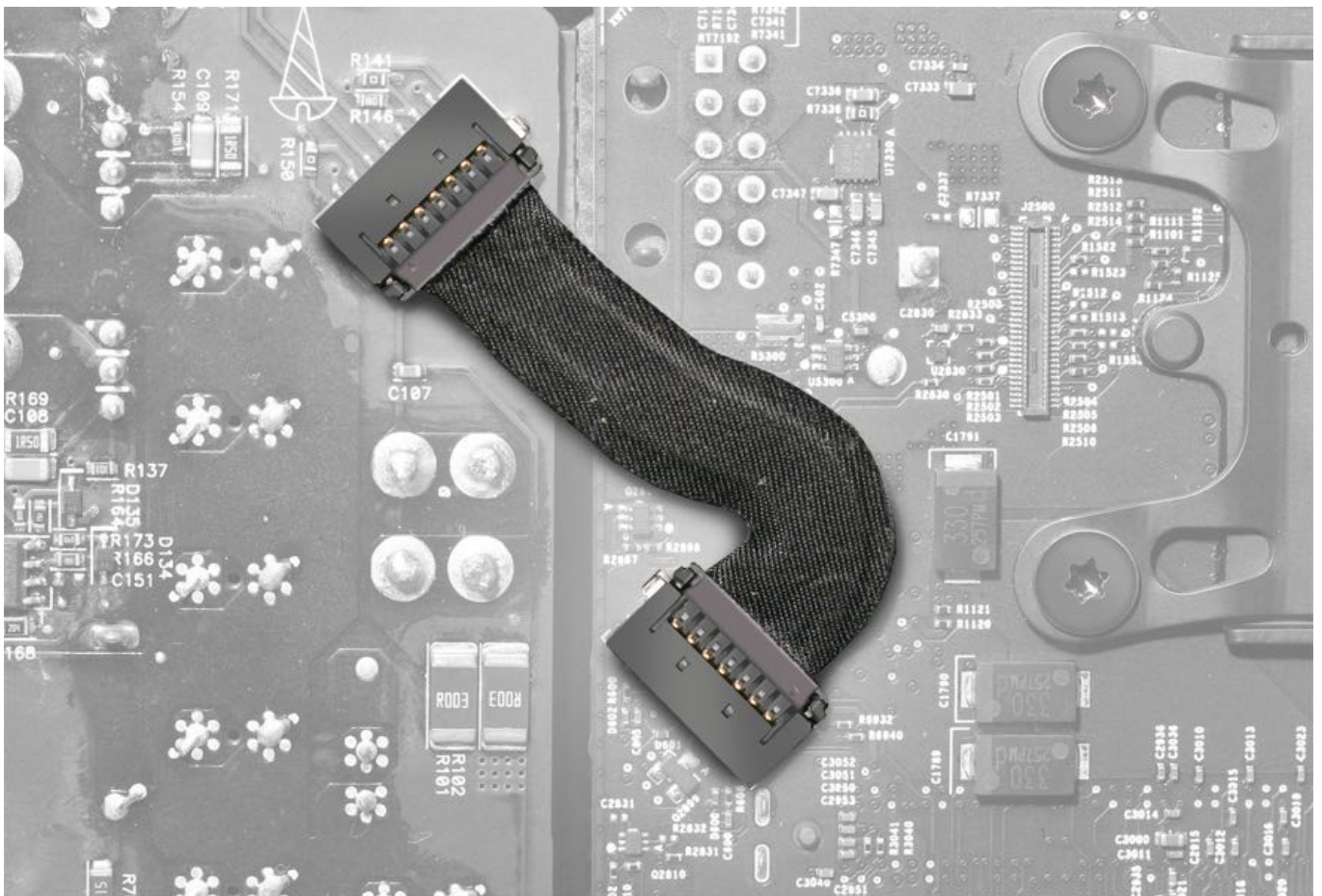
Steps For Removal

Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

1. Disconnect the power supply signal cable from the power supply and the logic board.



Steps For Reassembly

1. Connect the power supply signal cable to the power supply and the logic board.
2. Install new [display panel VHB strips](#).
3. Reinstall the [display panel](#).

Logic Board

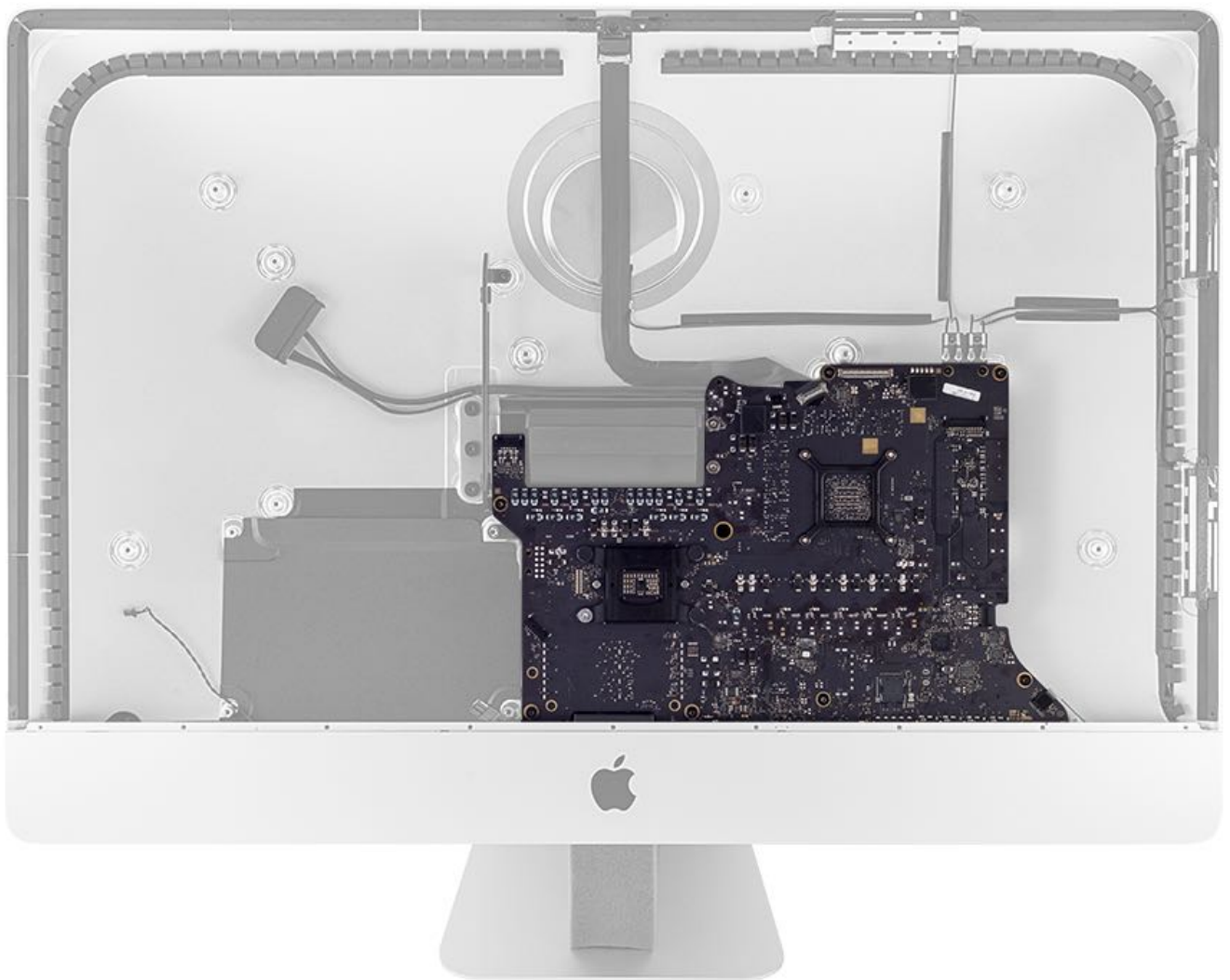
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About AppleCare service certifications](#).

For video instruction, refer to article [SV245: Logic Board Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)



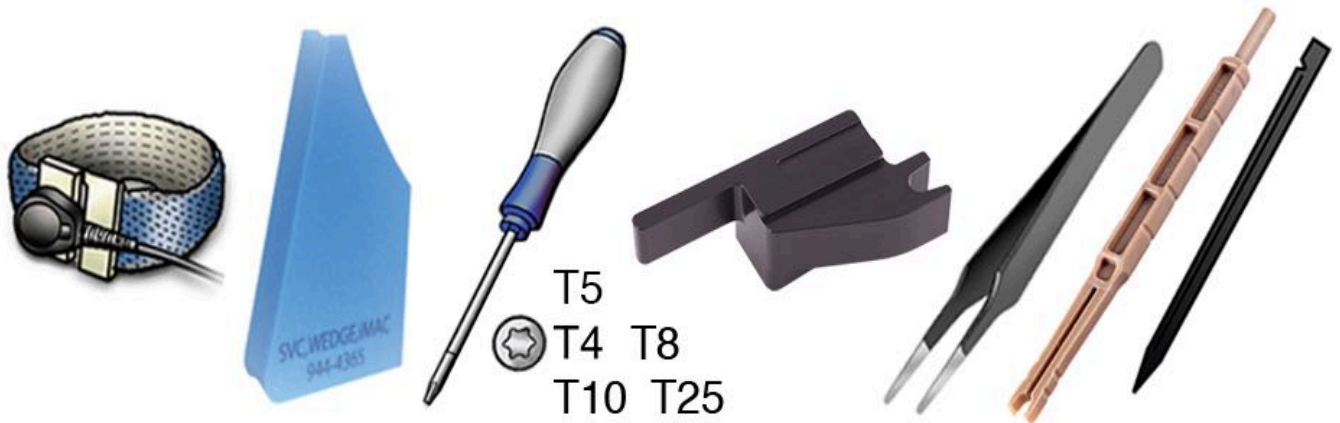
Tools

- ESD wrist strap and mat
- Torx T4 screwdriver (for wireless card removal)
- Torx T5 screwdriver
- Torx T8 screwdriver
- Torx T10 screwdriver
- Torx T25 screwdriver
- Service wedge (iMac)
- Black stick
- Wireless card support tool (923-01807)
- Antenna tool (923-01322) or an ESD-safe tweezers

- Thunderbolt cable or one USB-C cable for reassembly (not pictured)

If you are replacing the wireless card, the following tools will also be needed:

- Black stick
- Thermal pad kit, 076-1445
- Isopropyl alcohol (IPA) wipes



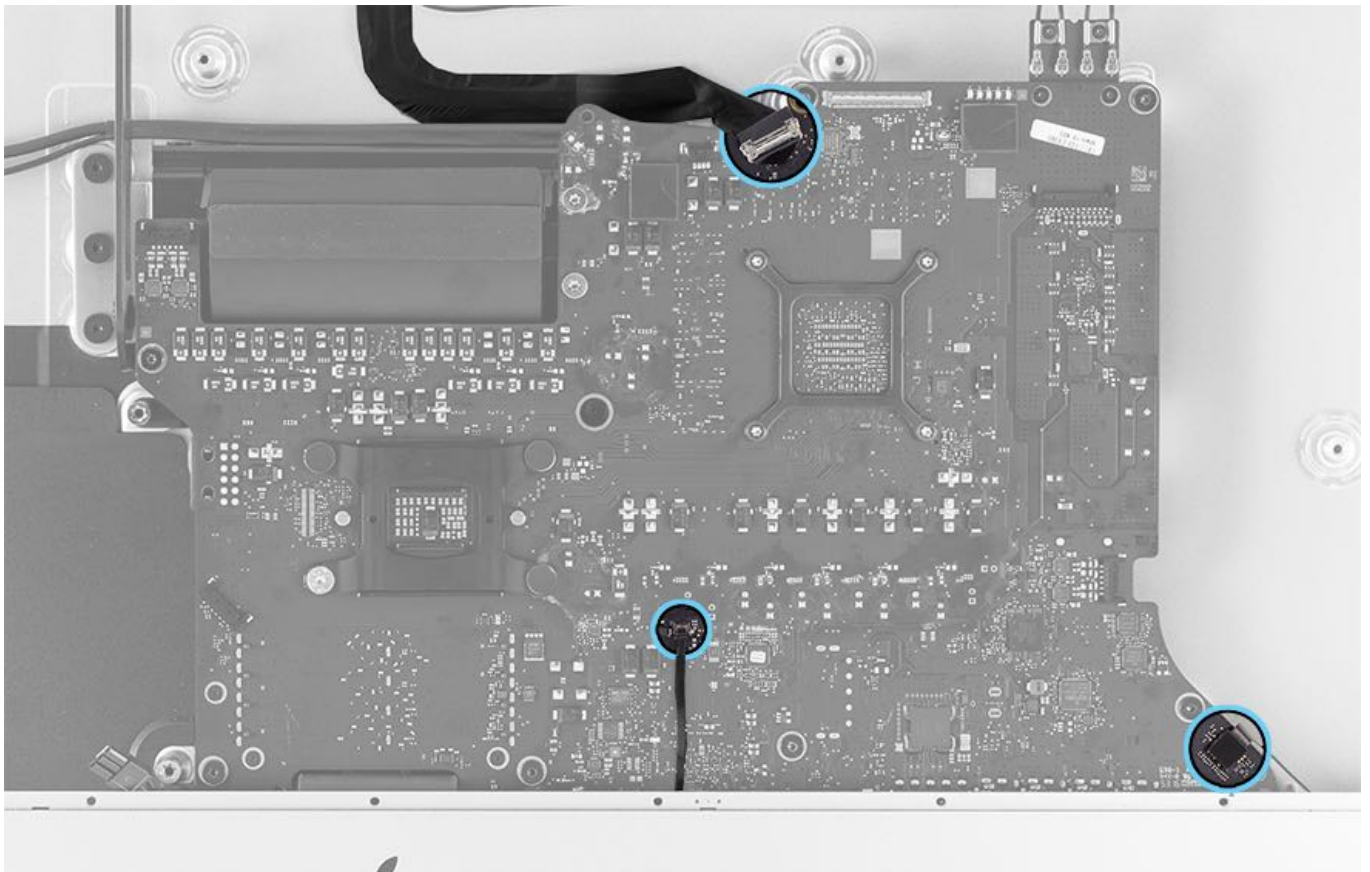
Steps For Removal

1. Carefully disconnect the following from the logic board:

- Camera connector with lock bar (top center of the board – flip the bar toward the cable)
- Audio connector (lower right corner)
- Microphone flex cable (lower middle on the board – flip the lever toward the cable)
 - Carefully tape the microphone flex cable to the rear housing (see second image)

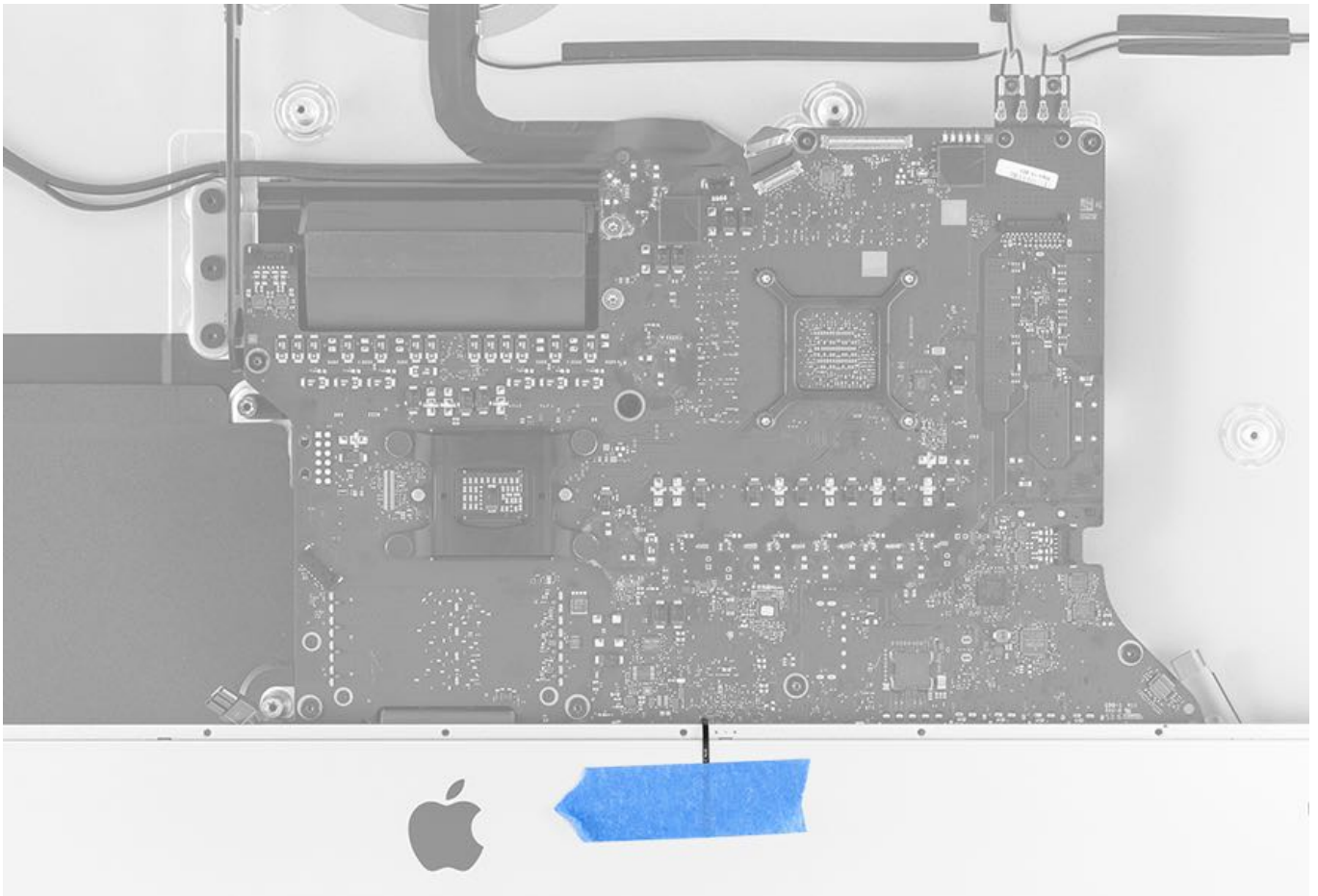


Caution: Be very careful with the microphone flex cable. A broken microphone flex cable requires a replacement the rear housing.



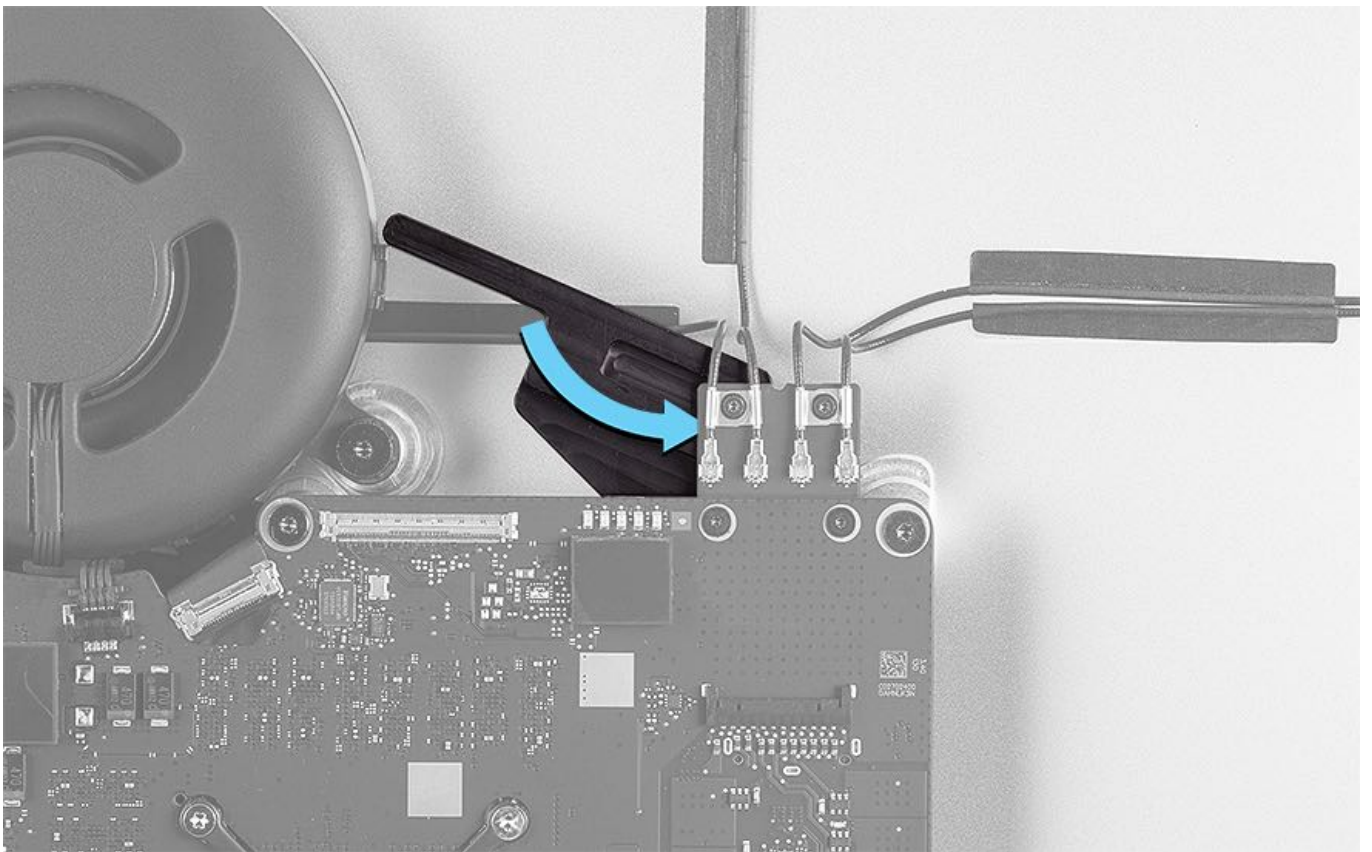


Caution: Be very careful not to crimp or over-bend the microphone flex cable. Carefully bend the cable and tape it to the rear housing.

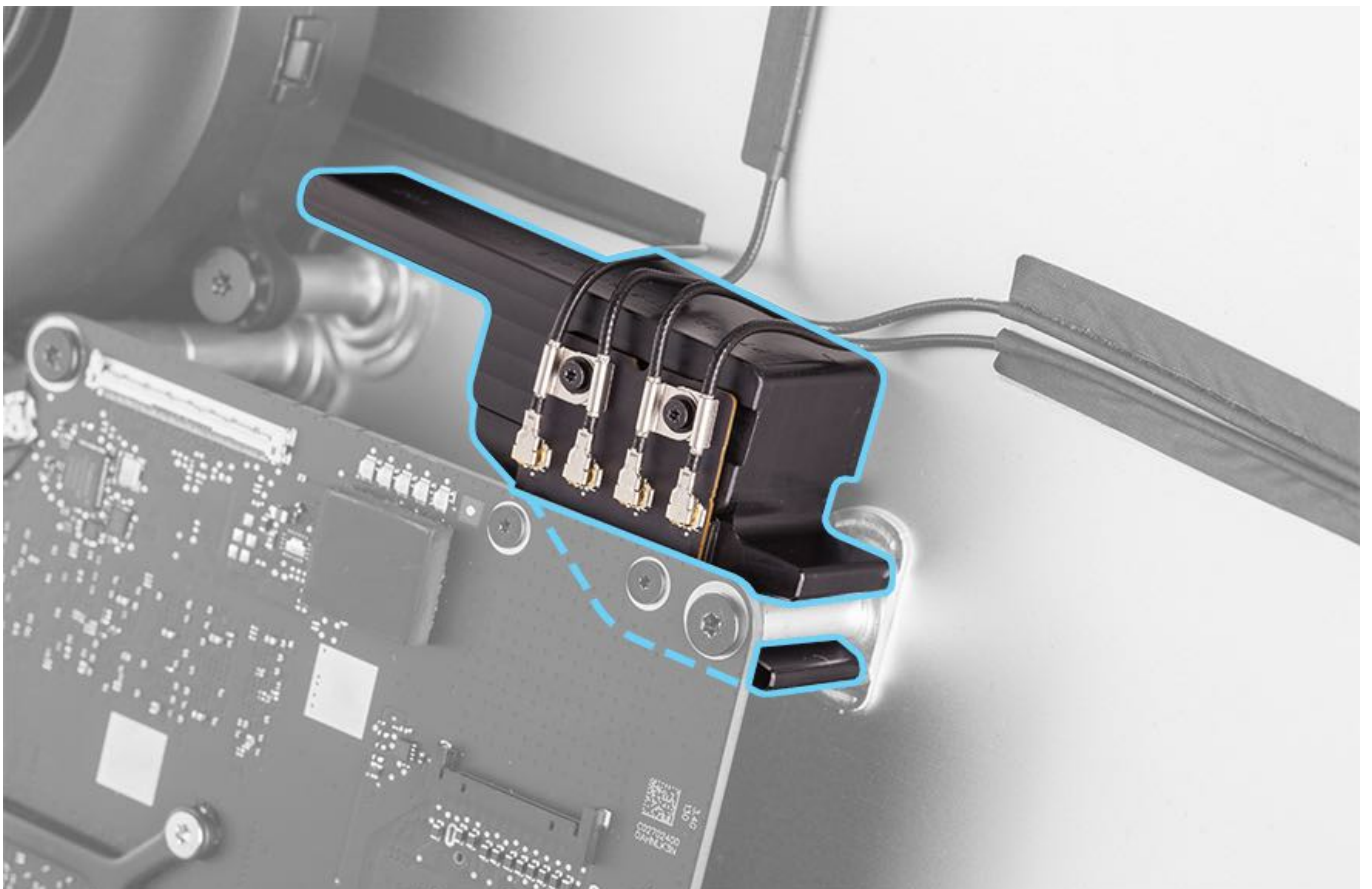


2. To protect the wireless card, slide the wireless card support tool into place between the rear housing and the wireless card.

Note: Refer to the image in step 3 that shows the tool properly installed.

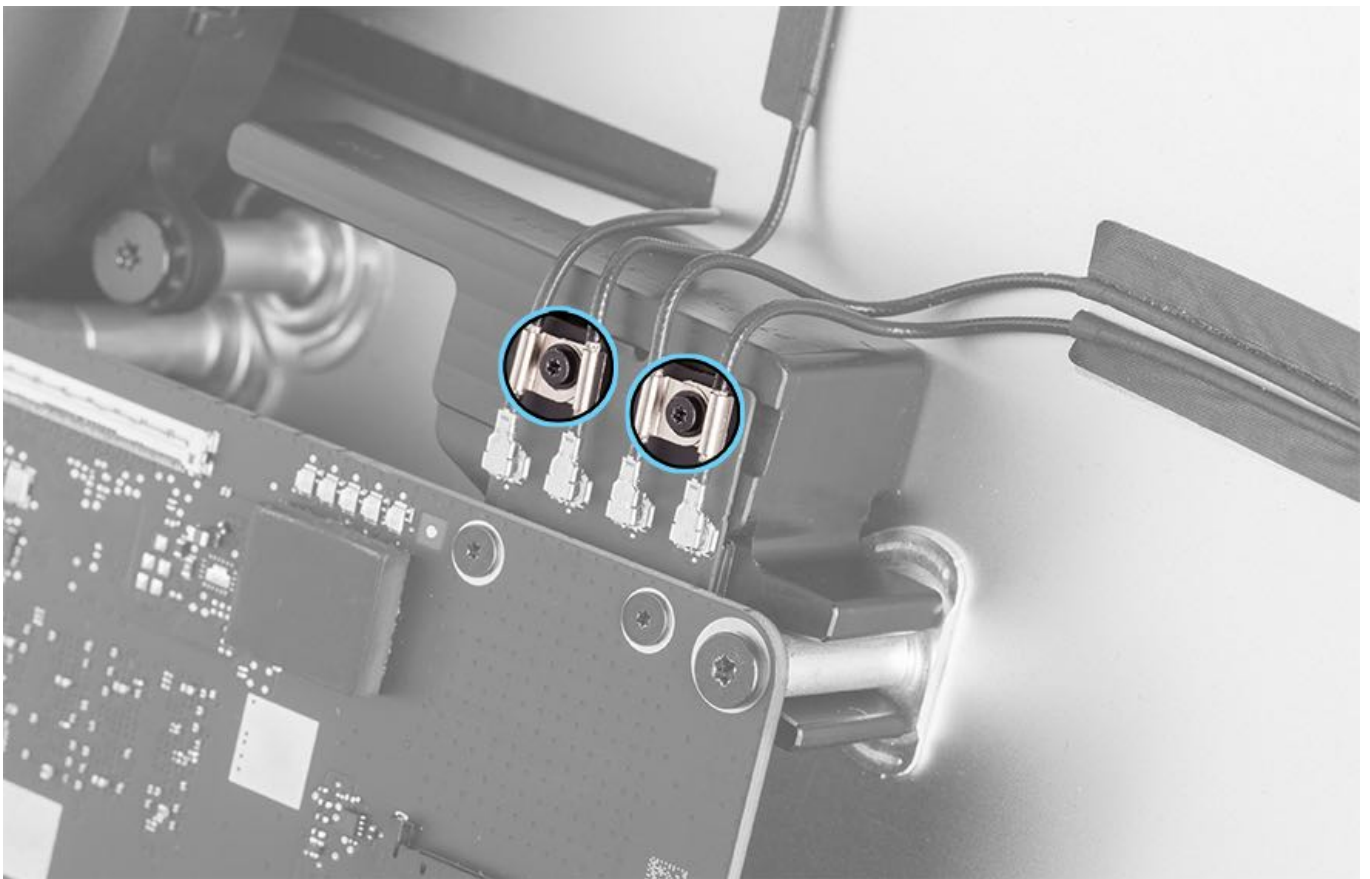


3. This image shows the wireless card support tool correctly installed behind the wireless card. Keep the tool installed whenever removing the wireless card screws or wireless antennas.



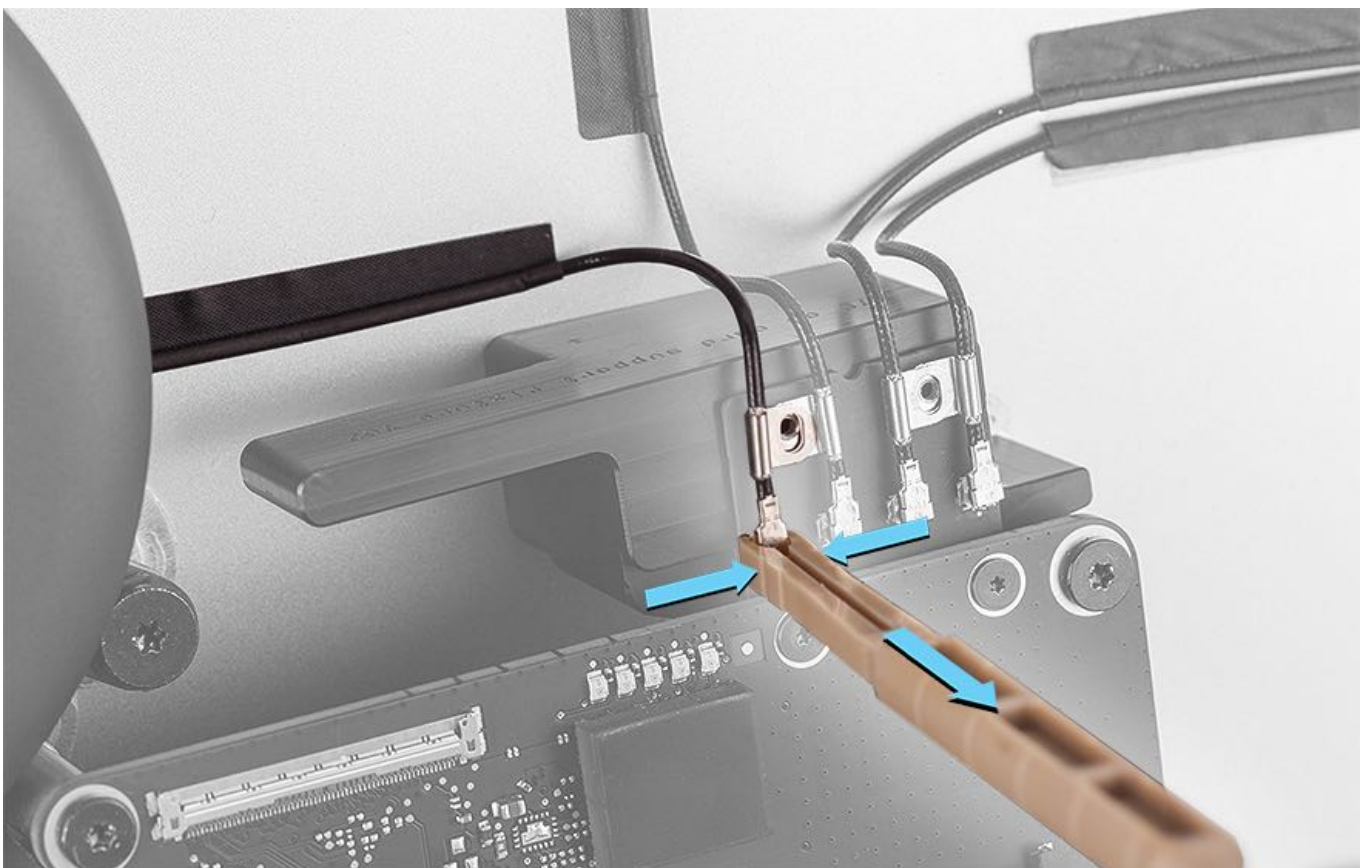
4. Remove two T5 screws from the wireless card.

- T5: 923-01667



5. Use the antenna tool or ESD-safe tweezers to disconnect the antennas from the wireless card.

Caution: If using metal tweezers, be careful not to crimp or damage the antenna.



6. Remove the support tool from the rear housing.

7. Remove seven T8 screws, two T10 screws, and one T25 standoff. Completely unscrew one T8 captive screw in the center of the board.

Screw legend:

- S = T8 short screw, four
 - 923-0331, short

- M = T8 medium long screw, one
 - 923-00767, 17.80 mm, long



- L = T8 long screw, two
 - 923-0396, 23 mm, long



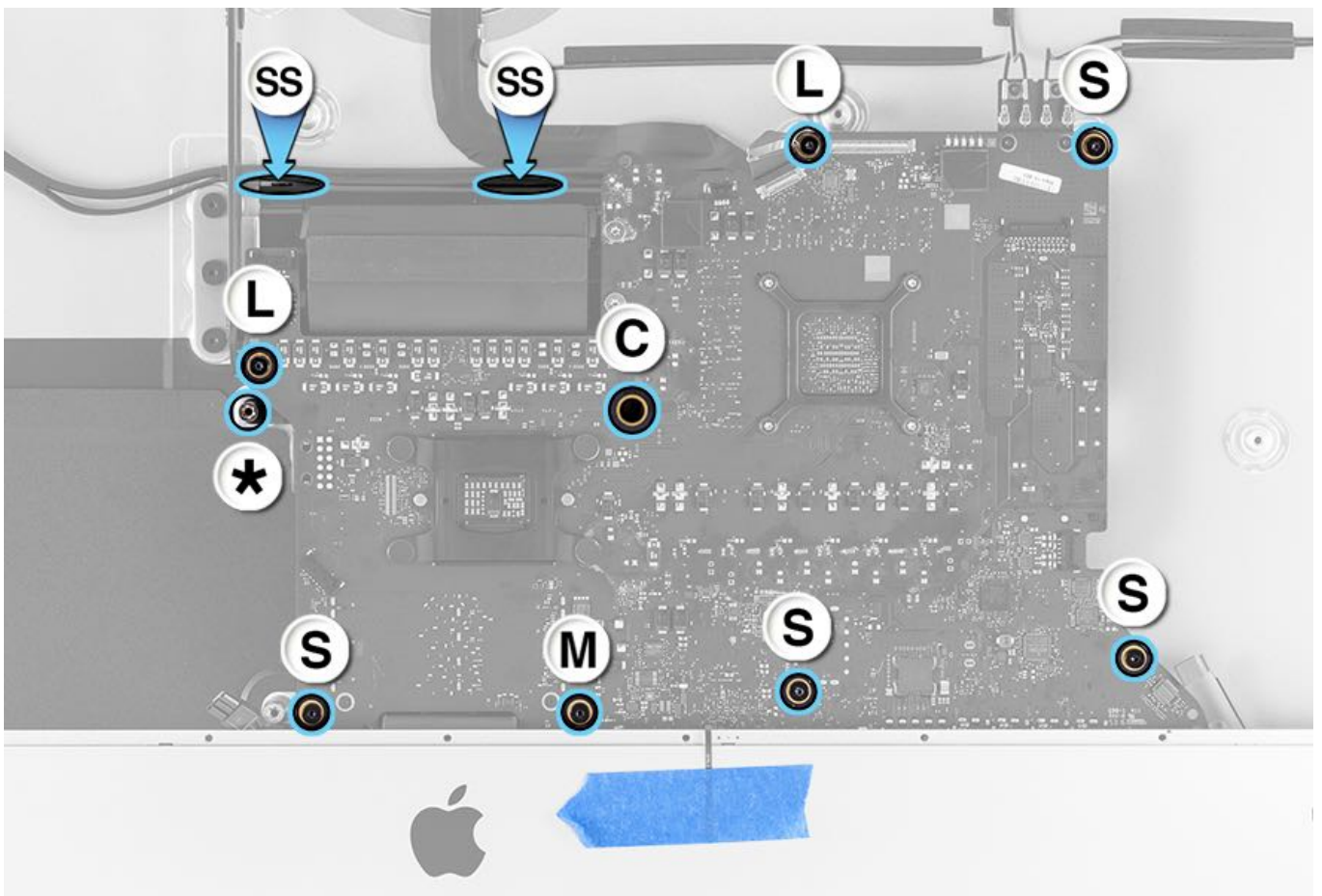
- SS = T10 short shoulder screw, two
 - 923-0395, short shoulder



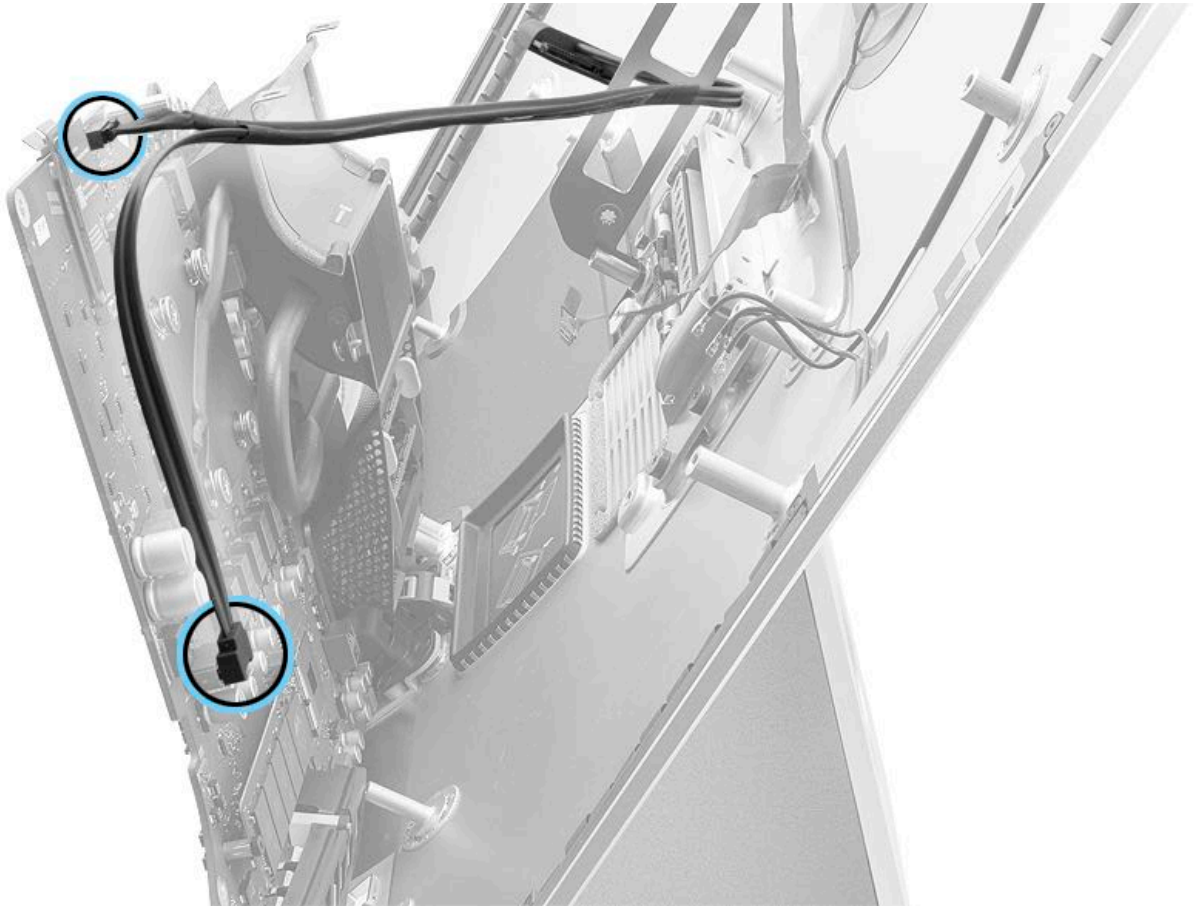
- * = T25 standoff, one
 - 923-0520, PSU standoff (with shorter thread)



- C = T8 captive screw, one
 - Located in the middle of the board
 - **Note:** The captive screw is part of the rear housing and is not available separately.



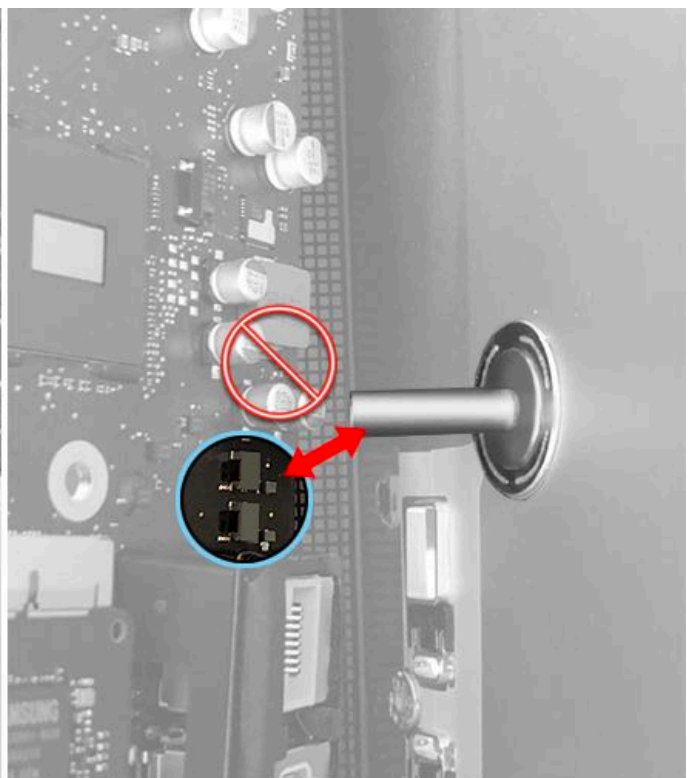
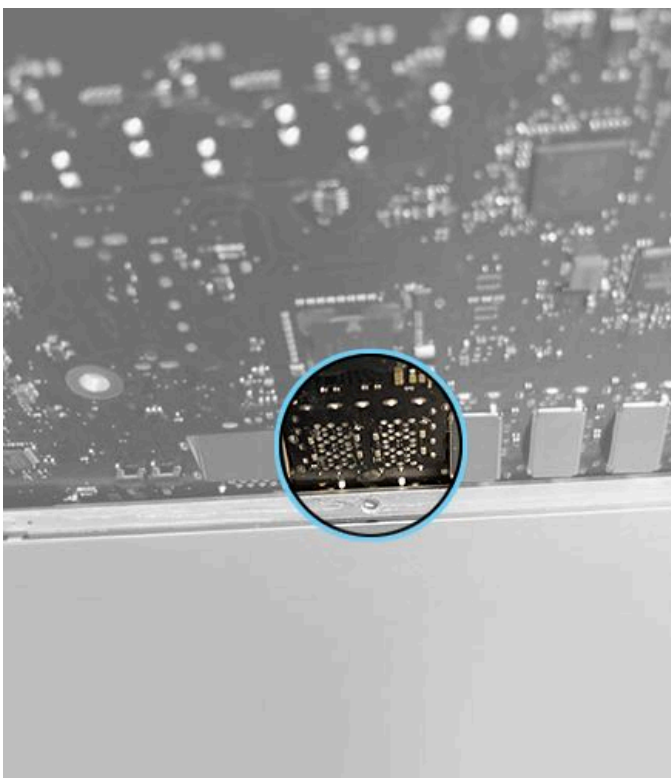
8. Carefully tilt the board forward. Disconnect the hard drive power (upper connector) and data cable (lower connector) from the two connectors on the back of the logic board. Pull the power end of the cable toward the rear housing. Pinch the clip on the data cable connector and pull toward the rear housing.



9. With two hands, carefully lift the logic board from the rear housing.

Caution: Handling the logic board incorrectly can damage chips and circuits. Be extremely careful when removing and replacing the logic board. Components that contact the enclosure, standoffs, or other modules may cause damage and prevent the iMac from operating correctly.

Pay particular attention to the areas in the images below when removing the logic board from the rear enclosure and replacing the logic board into the rear enclosure.



10. Verify that the tamper indicator labels on the heat sink are intact. If labels have been removed or tampered with, then the logic board is not eligible for exchange.

Steps For Reassembly

1. If you are installing a replacement logic board, transfer these parts from the old logic board:

- hard drive data and power cable
- memory
- power supply signal cable (short black cable that connects to the power supply and logic board)
- wireless card (if missing, apply thermal pad before installing)
- flash storage (if present)

2. Connect the hard drive data and power cable to the back of the logic board.

3. Insert the logic board into the rear housing.

4. Align the connectors with the ports, place the logic board screws, and partially tighten the screws to keep them in place – but **do not** fully tighten the screws at this point.

Screw legend:

- S = T8 short screw, four
 - 923-0331, short



- M = T8 medium long screw, one
 - 923-00767, 17.80 mm, long



- L = T8 long screw, two
 - 923-0396, 23 mm, long



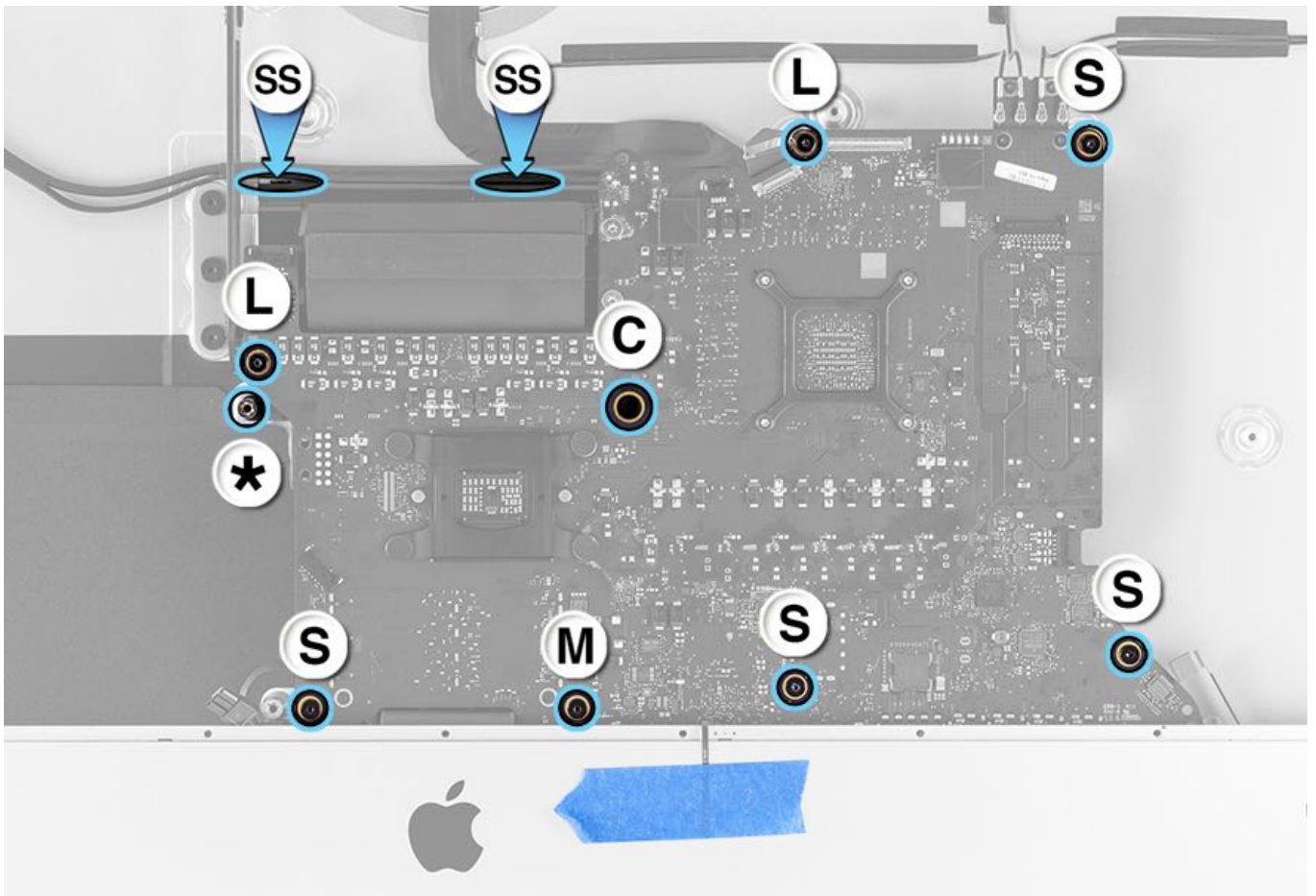
- SS = T10 short shoulder screw, two
 - 923-0395, short shoulder



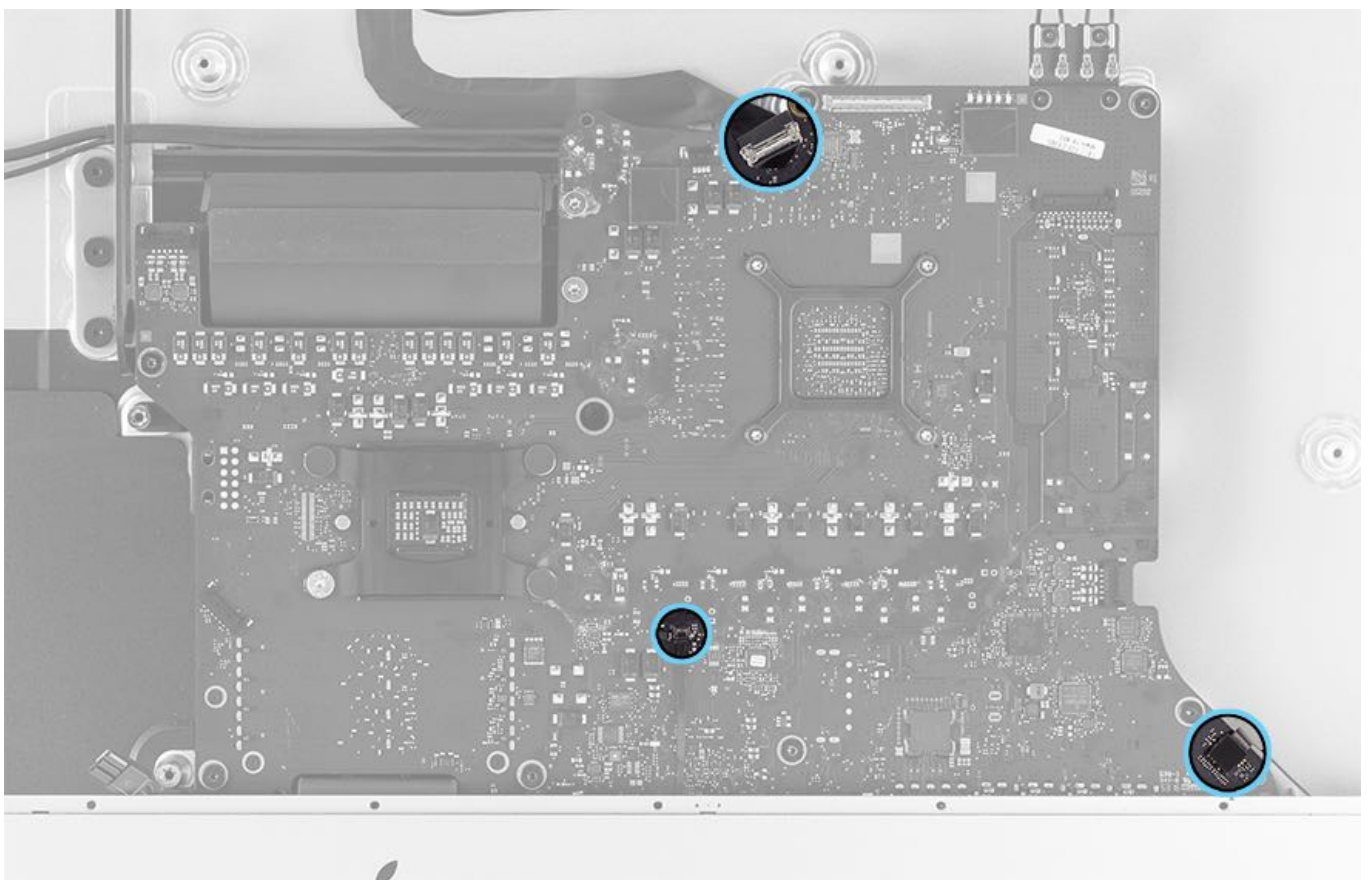
- * = T25 standoff, one
 - 923-0520, PSU standoff (with shorter thread)



- C = T8 captive screw, one
 - Located in the middle of the board
 - **Note:** The captive screw is part of the rear housing and is not available separately.



5. Reconnect the camera cable, audio connector, and microphone flex cable to the logic board.



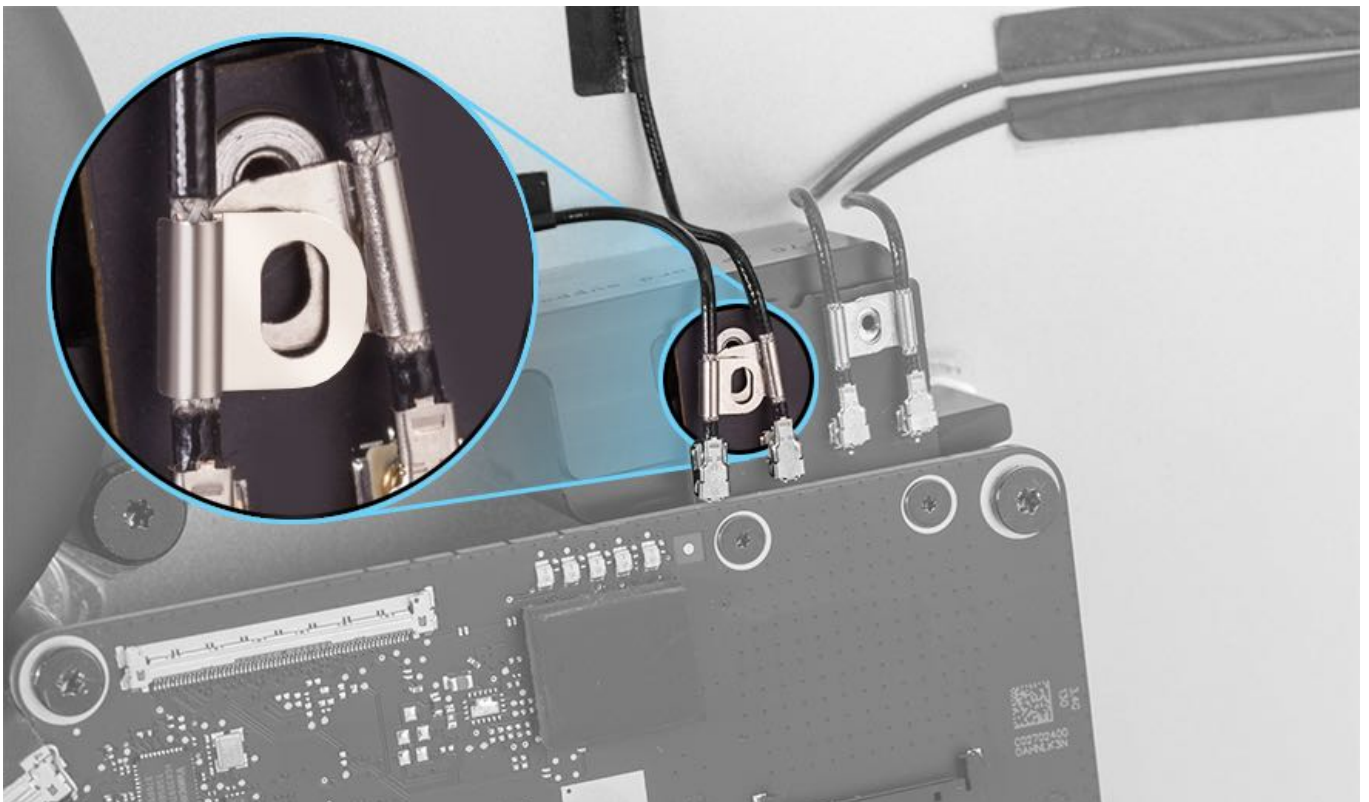
6. To ensure correct logic board alignment with the rear housing, plug in a USB-C cable, a Thunderbolt cable (shown), or SD card while tightening the logic board screws.



7. To protect the wireless card, slide the wireless card support tool (923-01807) into place between the rear housing and the wireless card. Reconnect the antennas to the wireless card using ESD-safe tweezers or the antenna tool.

8. Reinstall the two T5 screws and brackets to the wireless card. The brackets are placed left over right.

- T5: 923-01667



9. Remove the support tool from the rear housing.

10. Reinstall the [power supply](#).

11. Reinstall the [hard drive](#).

12. Reinstall the [left speaker](#).

13. Reinstall the [right speaker](#).

14. Reinstall the [chin strap](#).
15. Reinstall the [fan](#).
16. Install new [display panel VHB strips](#).
17. Reinstall the [display panel](#).

If installing a new replacement logic board:

18. Apply a new Ethernet ID label (included in box with new logic board) to the bottom of the stand or underside of VESA mount adapter.

19. Run Blank Board Serializer (BBS) to set the computer's serial number to the new logic board. BBS can be run from AST 1 or AST 2, or as a stand-alone, USB-based version found in article [SD63: Blank Board Serializer](#).

Note: When using Blank Board Serializer in AST 1 or AST 2, ensure that the unit under test (UUT) and the AST server are connected to the same network, and that the AST server has the latest software version installed.

20. Run the Mac BootROM Updater to ensure the replacement logic board's EFI BootROM firmware is updated to the latest version that supports the APFS file system.

Caution: Some Macs that have been updated to macOS High Sierra may not start up to the internal startup volume after a logic board replacement. On affected Macs, the Mac BootROM Updater is available to address this issue. This utility updates the EFI BootROM on affected Macs to allow starting up to a volume that has been updated to the APFS file system.

For more information about AST and AST 2, supported Mac models, and instructions for downloading and using these utilities, see article [OP476: Latest Apple Service Toolkit download links and documentation](#).

Flash Storage

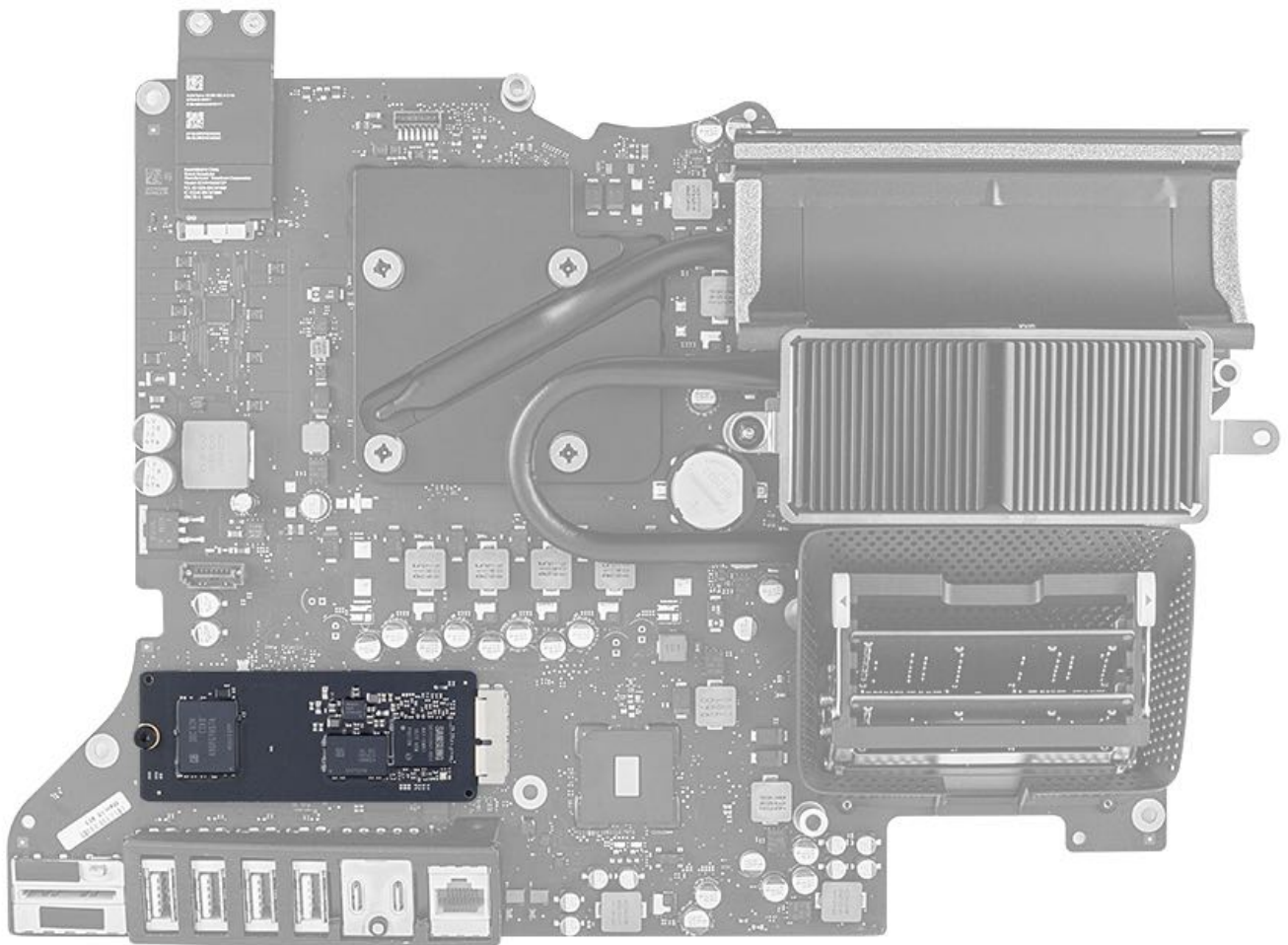
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV248: Flash Storage Replacement Video](#).

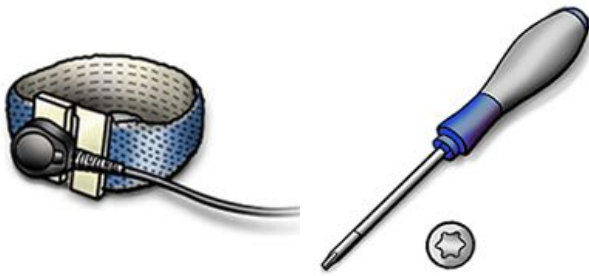
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)



Steps For Removal

Caution: Check that data is backed up before removing the SSD card or flash storage.

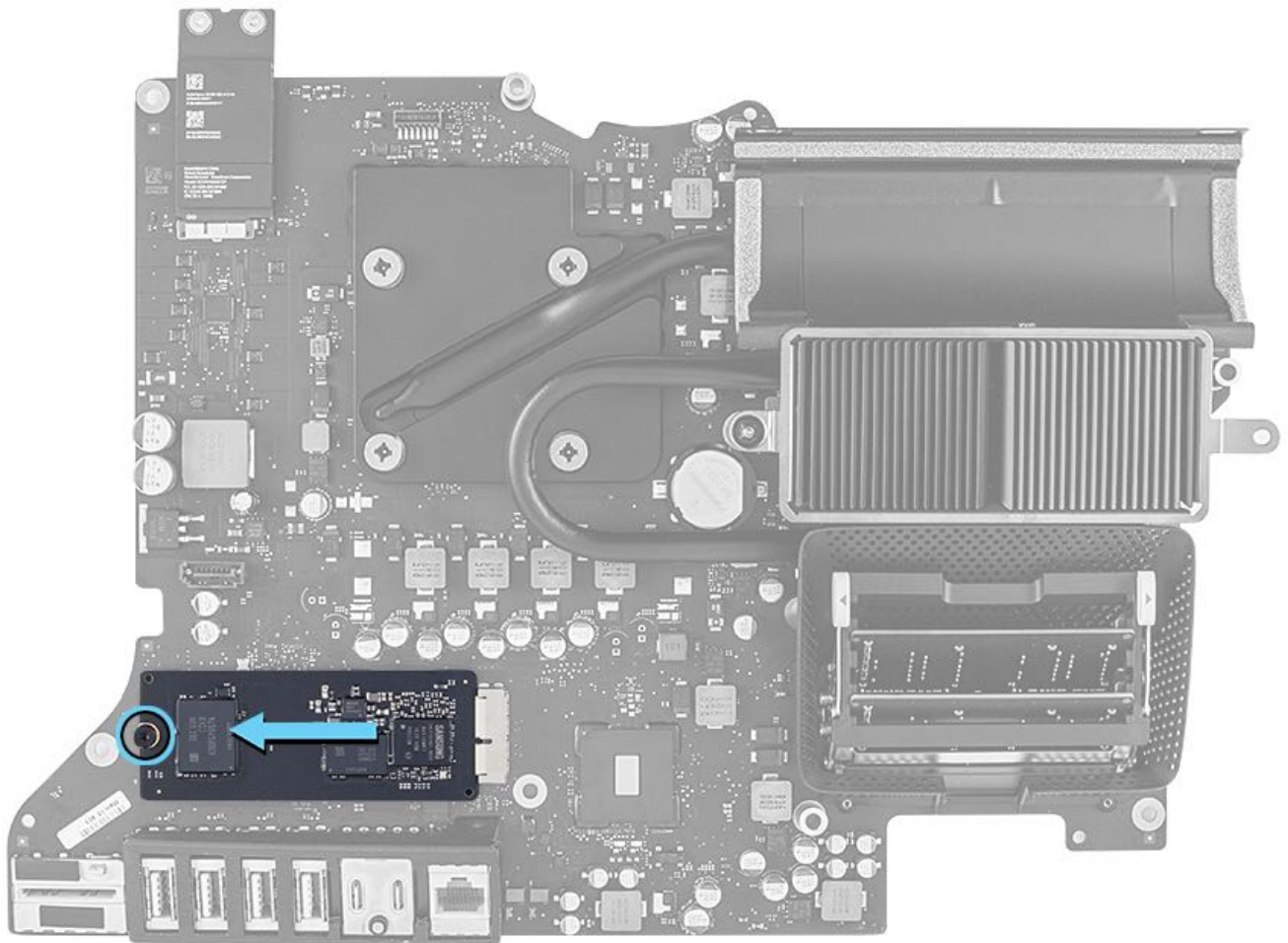
1. Remove one T8 screw from the SSD card or flash storage.

- T8: 923-0336

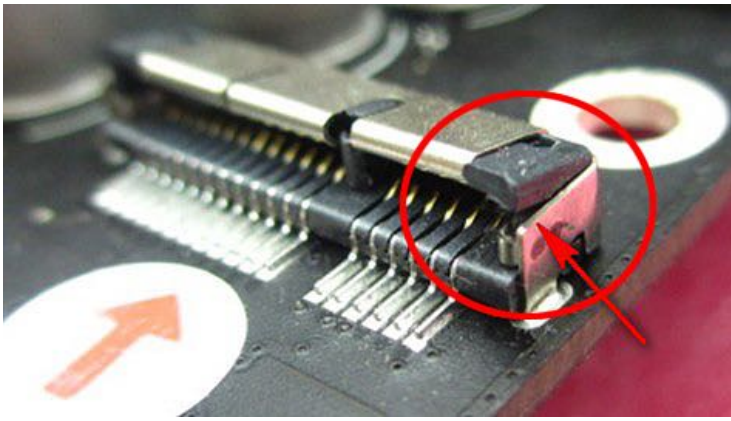


2. Gently pull the flash storage straight out of the connector.

Caution: Do not lift the flash storage at an angle when removing it from the connector. Damaging the connector requires a logic board replacement.



The image below shows an example of wireless card connector damage caused by lifting the wireless card at an angle during removal.



Steps For Reassembly

1. Insert the SSD card or flash storage straight into the logic board connector.

Caution: Do not lift the flash storage at an angle when inserting it into the connector. Lifting the flash storage at an angle can damage the flash storage connector on the logic board and warrant a logic board replacement.

2. Install one T8 screw to the SSD card or flash storage.
3. Reinstall the [logic board](#).
4. Reinstall the [power supply](#).
5. Reinstall the [hard drive](#).
6. Reinstall the [left speaker](#).
7. Reinstall the [right speaker](#).
8. Reinstall the [chin strap](#).
9. Reinstall the [fan](#).
10. Install new [display panel VHB strips](#).
11. Reinstall the [display panel](#).
12. Refer to article [TP767: Reinstalling Software That Came with the Computer](#).

Reinstalling Software That Came with the Computer

Reinstalling Software That Came with the Computer

This procedure requires an Internet connection.

Note: In some situations, a user may have set a firmware password. The user must know the firmware password in order to reinstall OS X or macOS. If the user cannot remember the password, then refer to the technician instructions in [HT204455: How to set a firmware password on your Mac](#).

Important: Apple recommends that users back up their data before any software restore procedure. Back up essential files before installing OS X or macOS. Apple is not responsible for any loss of data. For instructions on using Time Machine, refer to [HT201250: How to use Time Machine to back up or restore your Mac](#).

For instructions on reinstalling the OS, follow the steps in [HT204904: How to reinstall macOS](#).

For more information about recovery mode, refer to [HT201314: About macOS Recovery](#).

Wireless Card

First Steps

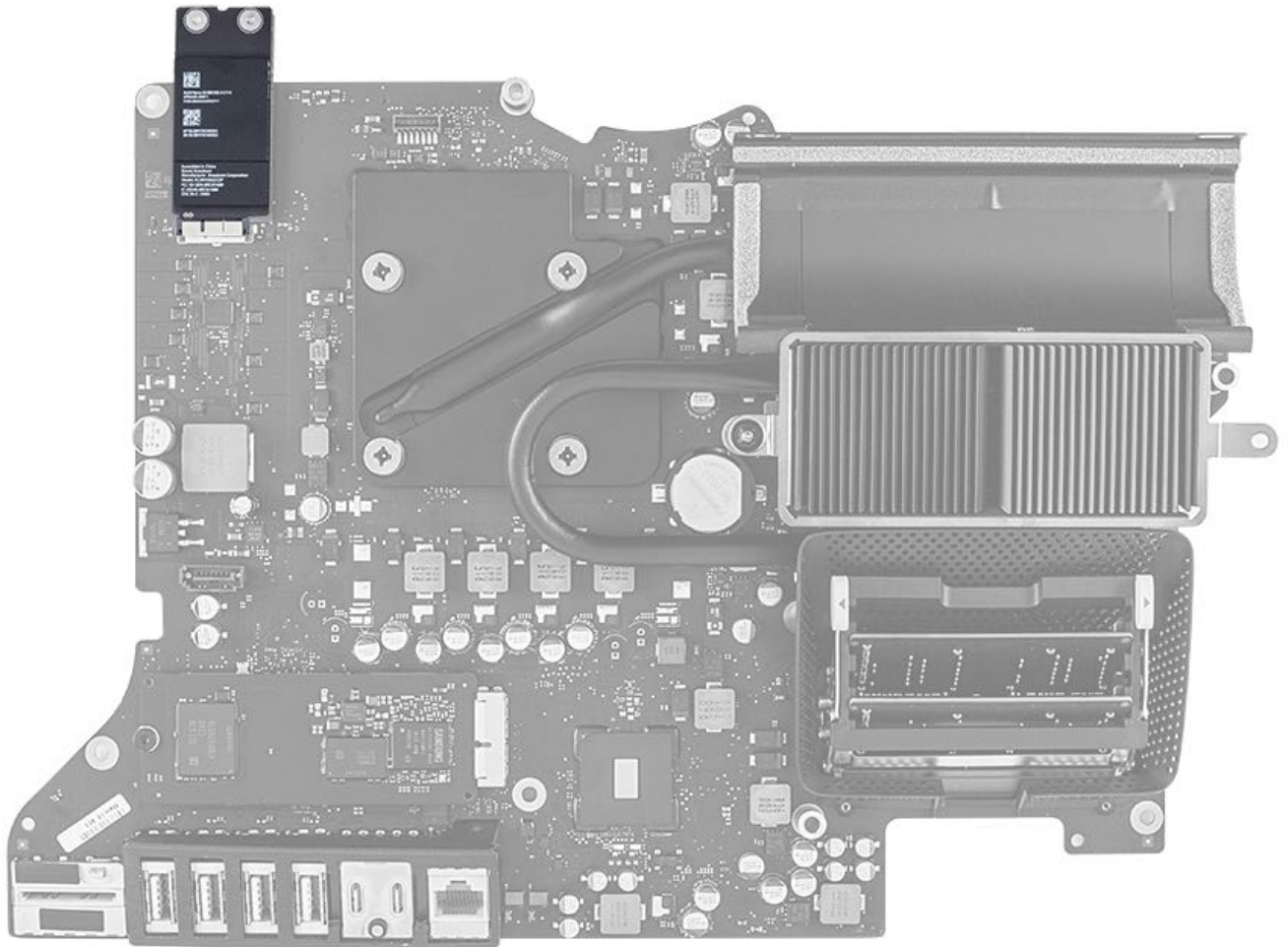
Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV249: Wireless Card Replacement Video](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)

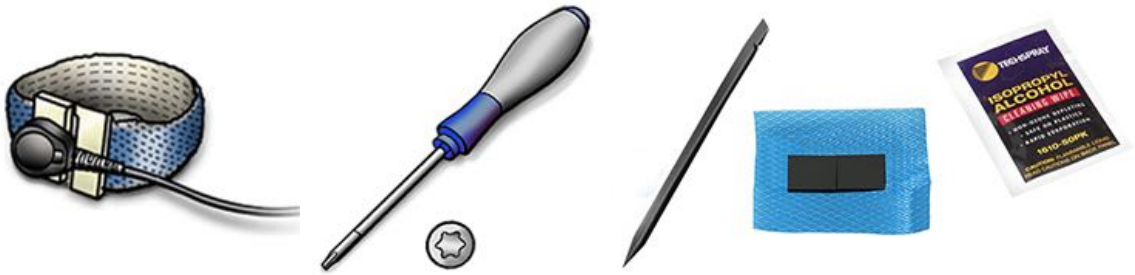
Caution: Do not remove the wireless card without taking out the logic board. Attempting to do this is likely to damage both the wireless card and the logic board. Additionally, the use of thermal material during installation will make it difficult to insert the card if the logic board has not been removed.



Tools

- ESD wrist strap and mat
- Magnetized Torx T4 screwdriver
- Black stick
- Thermal pad kit (076-1445)
- Isopropyl alcohol (IPA) wipes

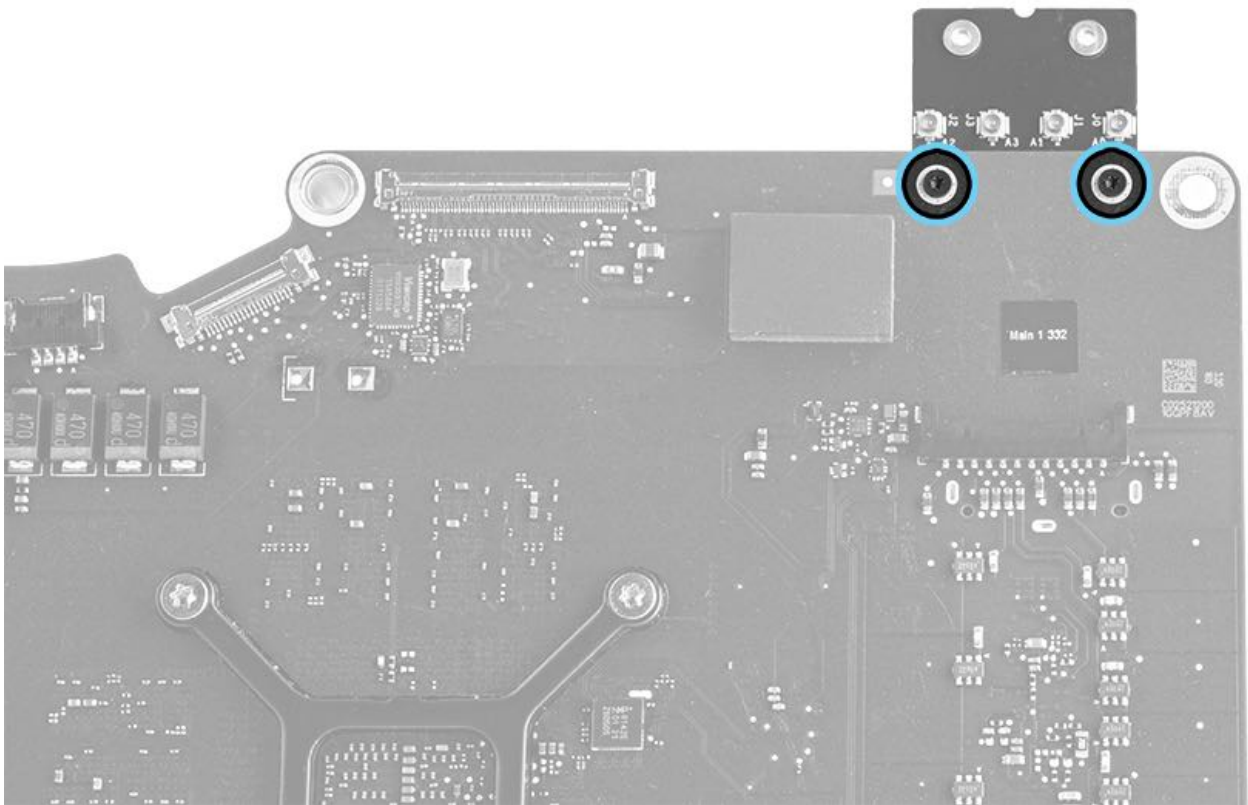
Note: Whenever you remove or replace the wireless card, check for original thermal material. If it is present, then remove the original thermal material, clean with an IPA wipe, and install one thermal pad to the wireless card.



Steps For Removal

1. Remove the two T4 screws that secure the wireless card to the logic board.

- T4: 923-00670



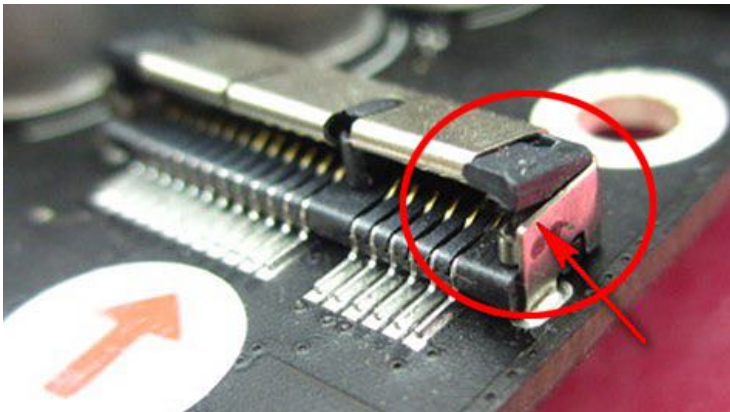
2. Turn over the logic board and use a black stick to gently loosen the bond of thermal material between the logic board and wireless card.

Important: Exerting too much force when trying to loosen the bond of the thermal material could damage the wireless card connector. See an example of a damaged connector in step 3.

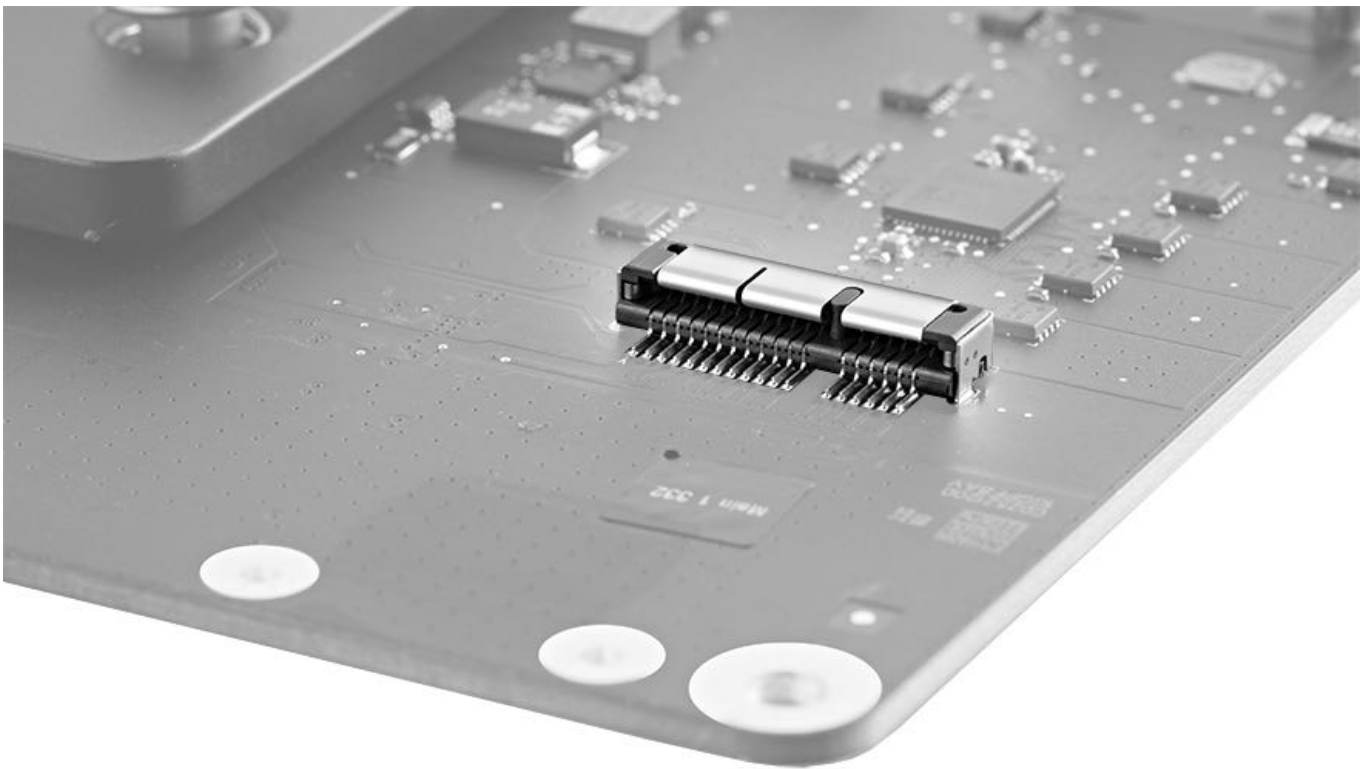


3. **Important:** A damaged wireless card connector requires a logic board replacement.

Damaged iMac (21.5-inch, Late 2012) wireless card connector:



Intact iMac (Retina 5K, 27-inch, Late 2015) wireless card connector:



4. Gently wiggle the wireless card straight out of the wireless card connector.



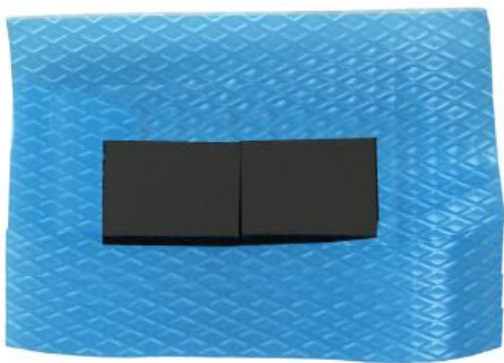
5. If thermal material is present, then use IPA wipes to carefully clean both the logic board and the wireless card. Harsh scraping can damage the delicate circuitry.

Steps For Reassembly

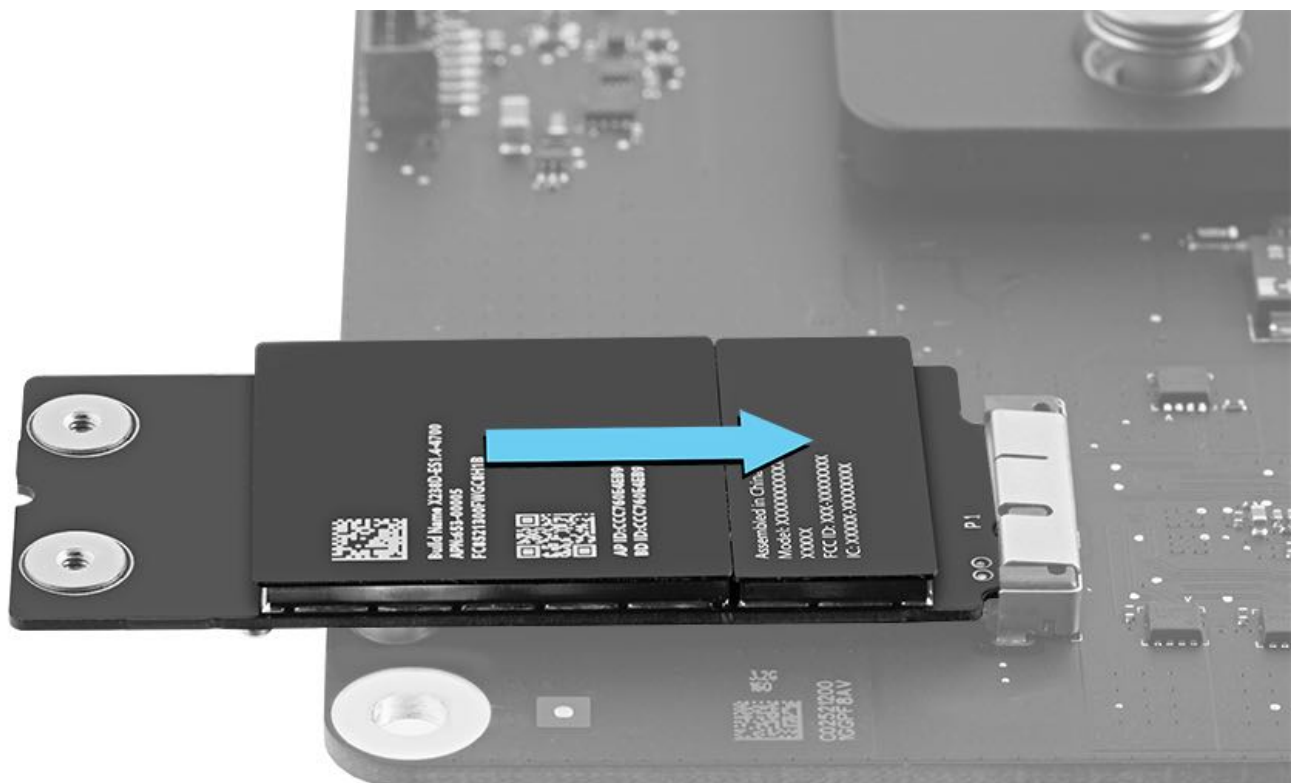
1. Check the condition of the thermal pad on the replacement wireless card. A damaged thermal pad shows uneven borders or lost adhesion.



2. If a new thermal pad is required, then use one from the thermal pad kit (076-1445). Attach one thermal pad to the card.

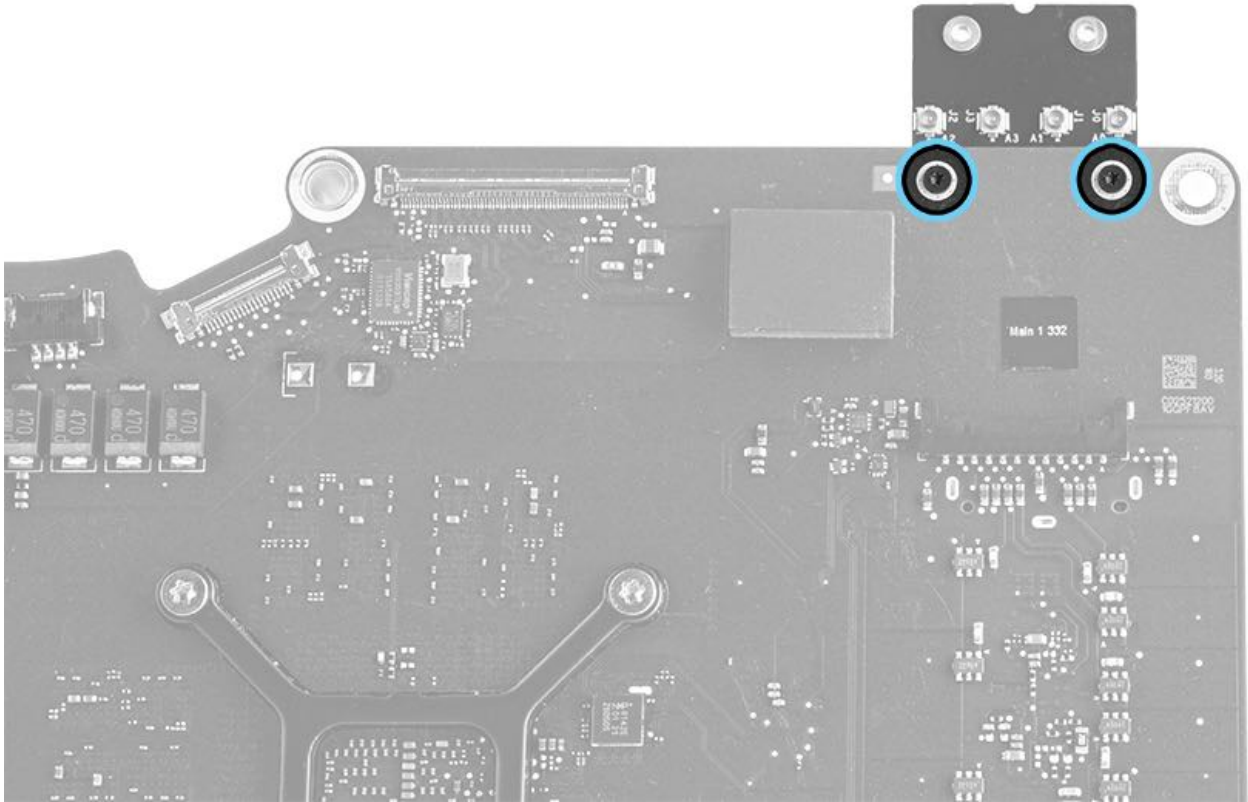


3. Hold the wireless card by the edges and slide it into the connector on the logic board.



4. Turn over the logic board and install the two T4 screws.

- T4: 923-00670



5. Reinstall the [logic board](#).
6. Reinstall the [power supply](#).
7. Reinstall the [hard drive](#).
8. Reinstall the [left speaker](#).
9. Reinstall the [right speaker](#).
10. Reinstall the [chin strap](#).
11. Reinstall the [fan](#).
12. Install new [display panel VHB strips](#).
13. Reinstall the [display panel](#).

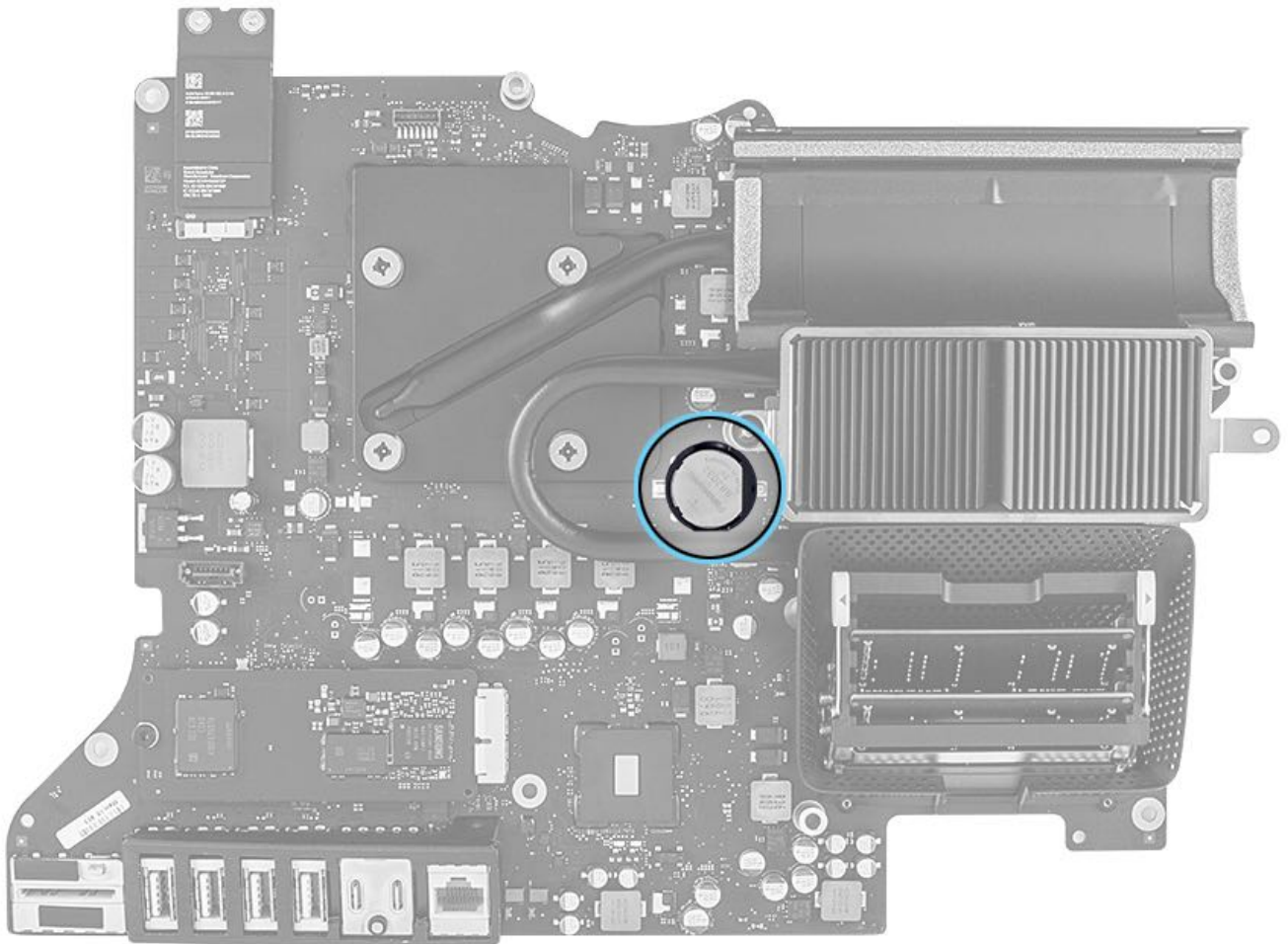
Battery

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



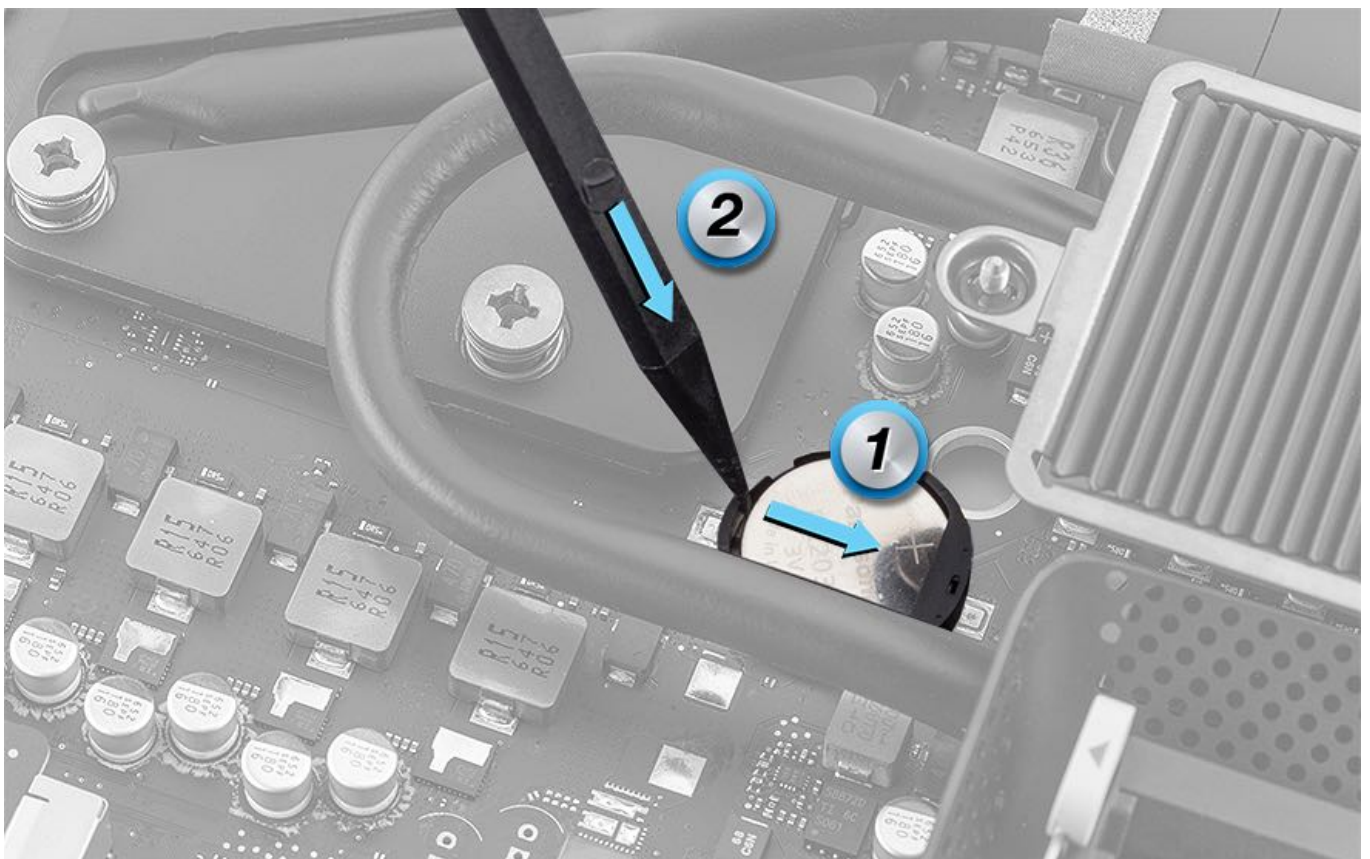
Tools

- ESD mat and wrist strap
- Black stick
- Service wedge (iMac)



Steps For Removal

1. Use your finger to push the battery forward (1), to open a tiny gap between the battery and the battery socket. Insert the tip of a black stick (2) into the socket and carefully pry the battery out of the socket.



Steps For Reassembly



Warning: If the battery is installed incorrectly or replaced with an incorrect type of battery, there is a risk of explosion. Dispose of used batteries according to local environmental laws and guidelines.

Note: Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery noted below is no longer available to order via GSX. When the Mac repair process indicates the noted coin battery needs to be replaced, please order it from an electronics parts distributor.

Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.

1. Check that the battery socket is open and free of dust.
2. Slide the battery (922-9869) into the socket with the engraved markings (+ side) facing up.



3. Reinstall the [logic board](#).
4. Reinstall the [power supply](#).
5. Reinstall the [hard drive](#).
6. Reinstall the [left speaker](#).
7. Reinstall the [right speaker](#).
8. Reinstall the [chin strap](#).
9. Reinstall the [fan](#).
10. Install new [display panel VHB strips](#).
11. Reinstall the [display panel](#).

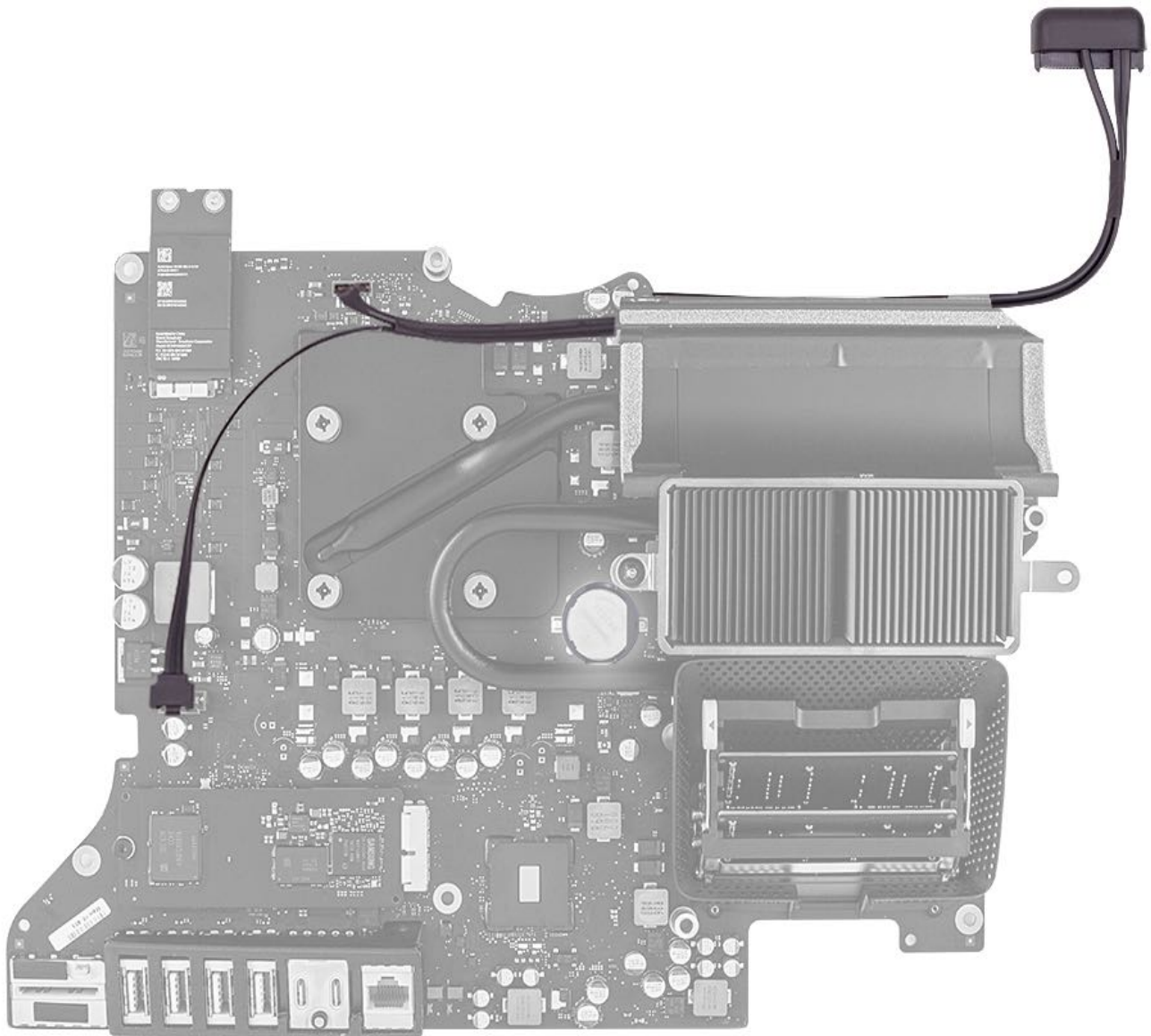
Hard Drive Data and Power Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



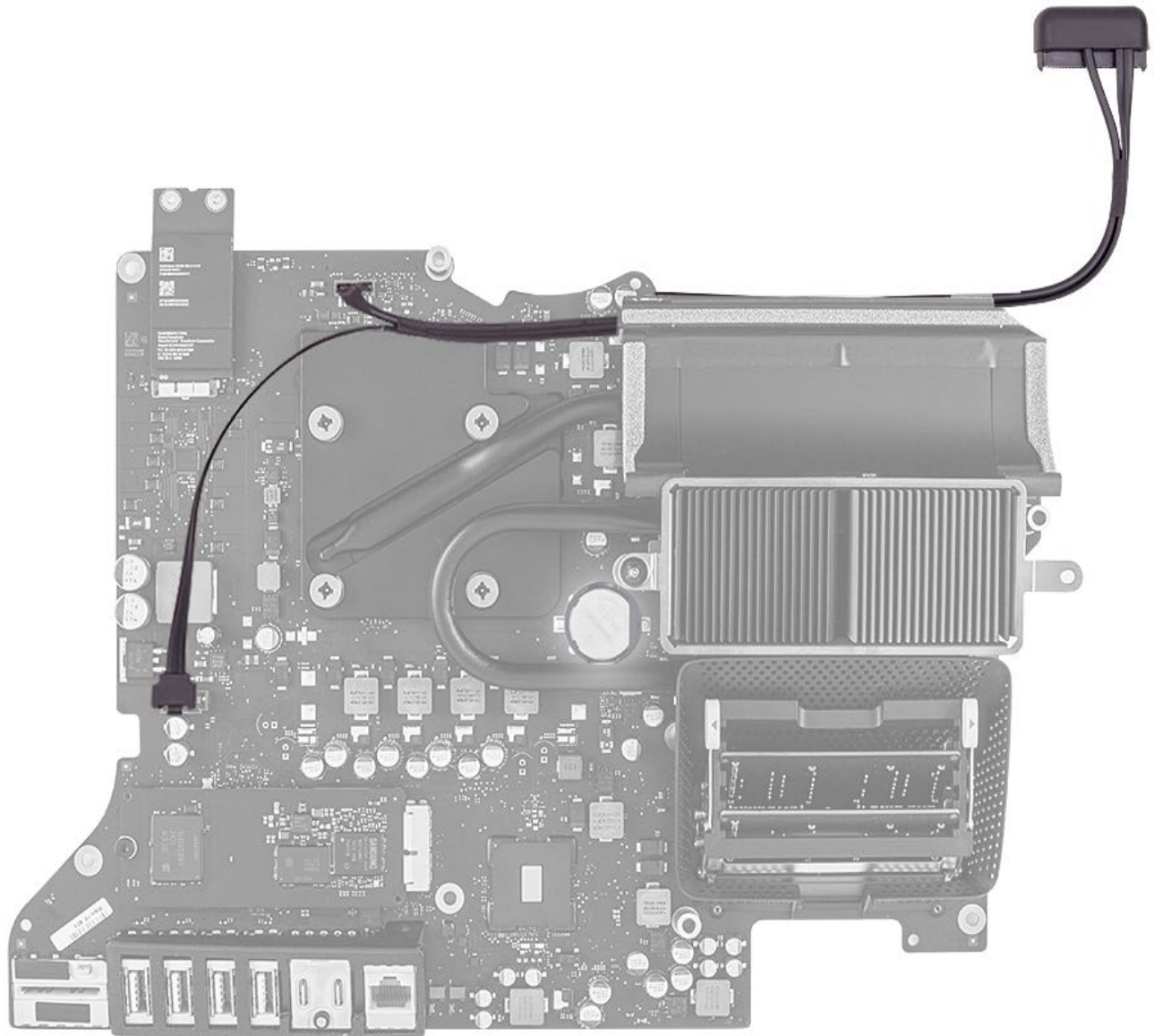
Tools

- ESD wrist strap and mat



Steps For Removal

1. Disconnect the hard drive data and power cable from the two connectors on the logic board.



Steps For Reassembly

1. Connect the hard drive data and power cable to the two connectors on the logic board.
2. Reinstall the [logic board](#).
3. Reinstall the [power supply](#).
4. Reinstall the [hard drive](#).
5. Reinstall the [left speaker](#).
6. Reinstall the [right speaker](#).

7. Reinstall the [chin strap](#).
8. Reinstall the [fan](#).
9. Install new [display panel VHB strips](#).
10. Reinstall the [display panel](#).

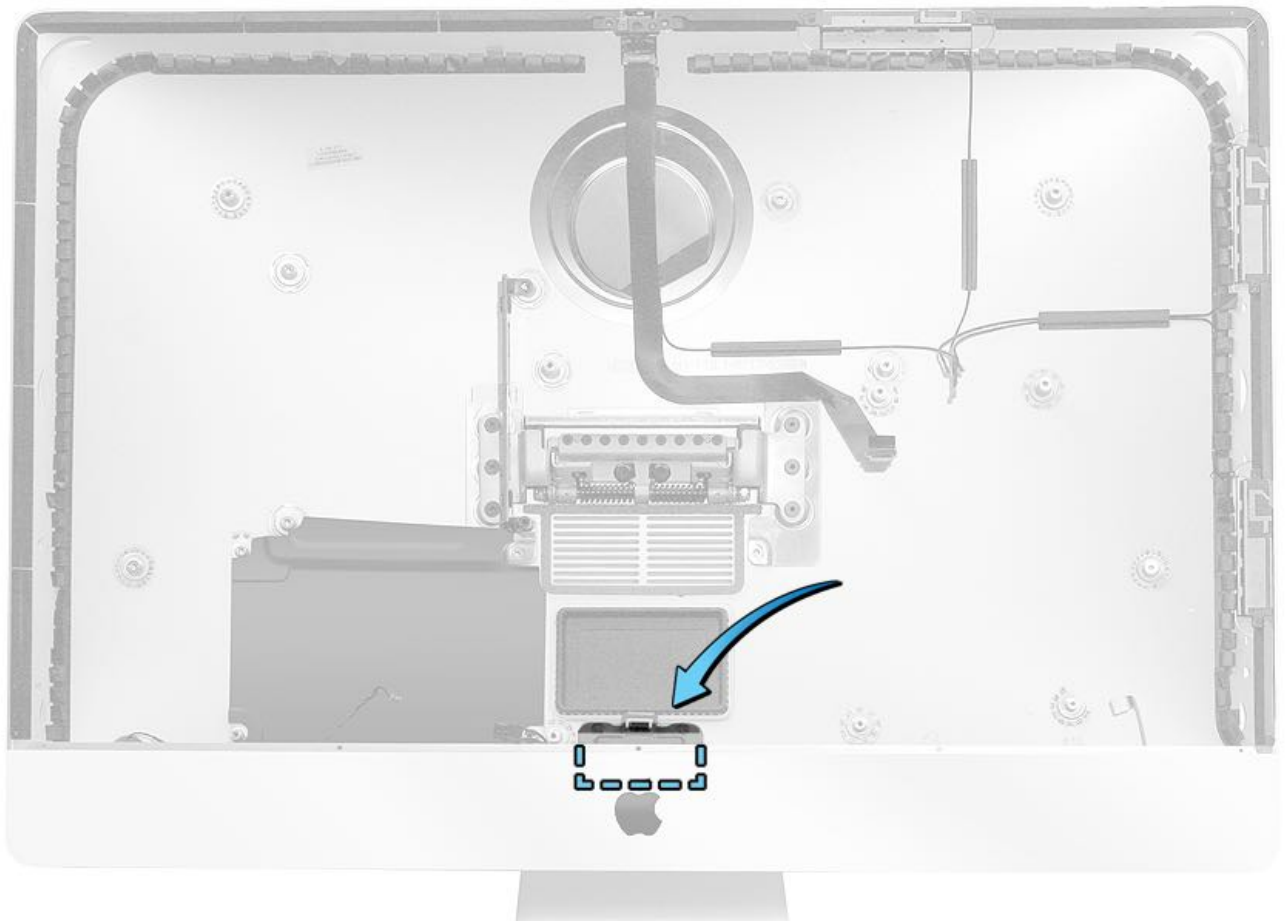
RAM Access Door Lock Mechanism

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

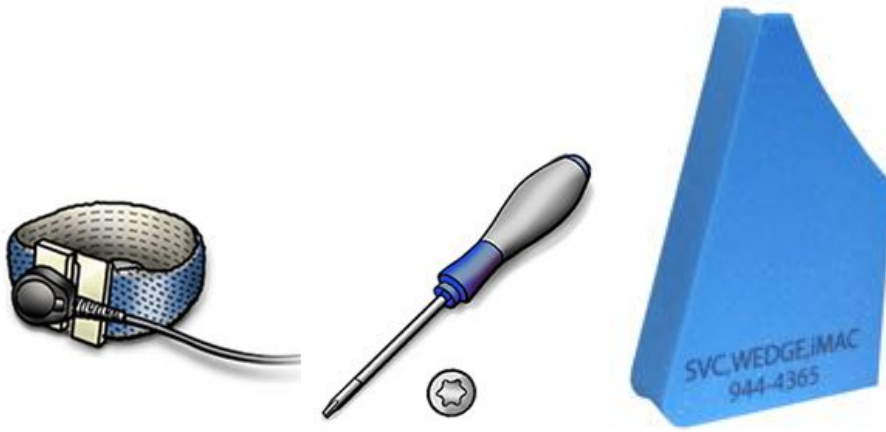
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)



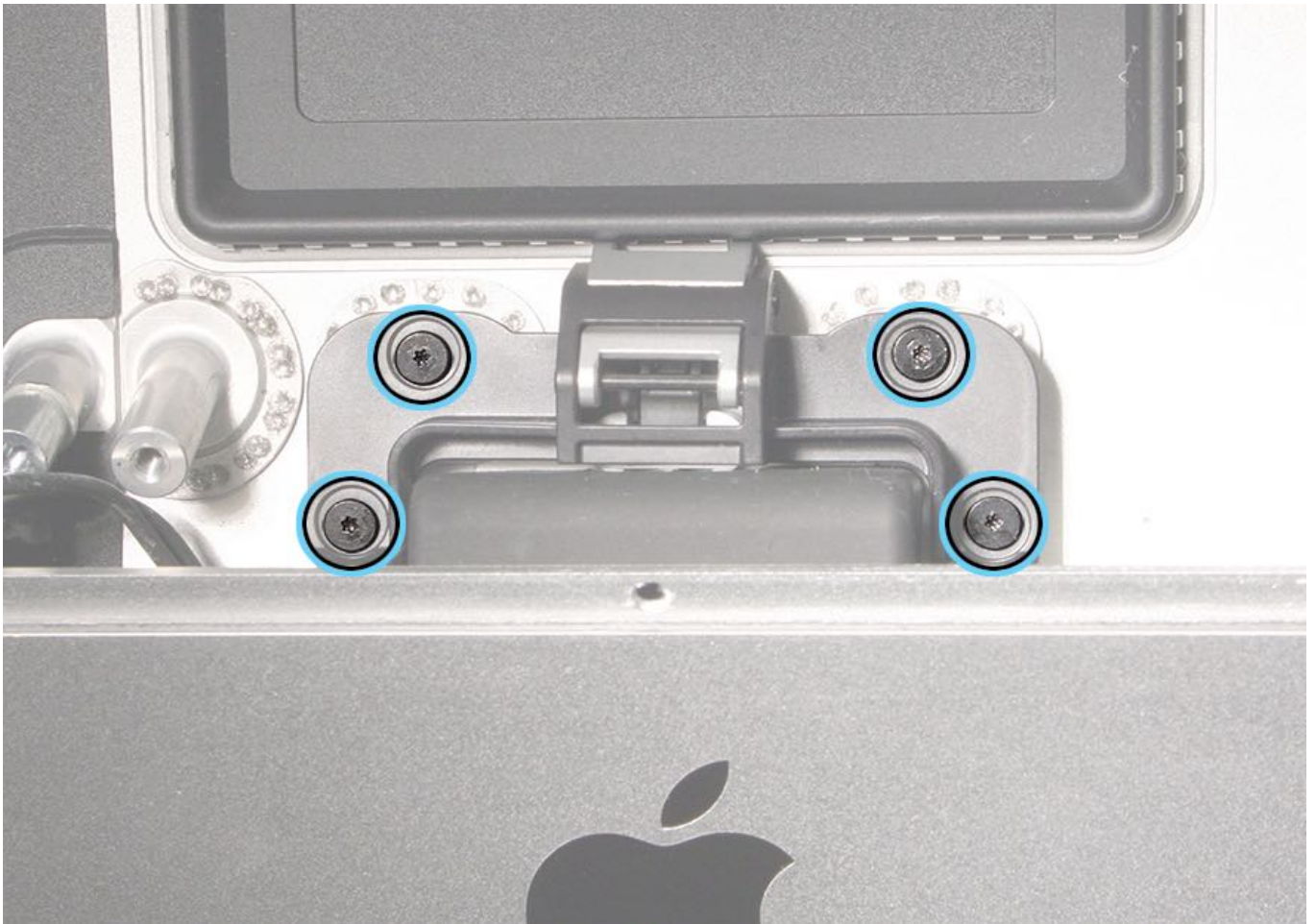
Tools

- ESD wrist strap and mat
- Torx T5 screwdriver (magnetized)
- Service wedge (iMac)



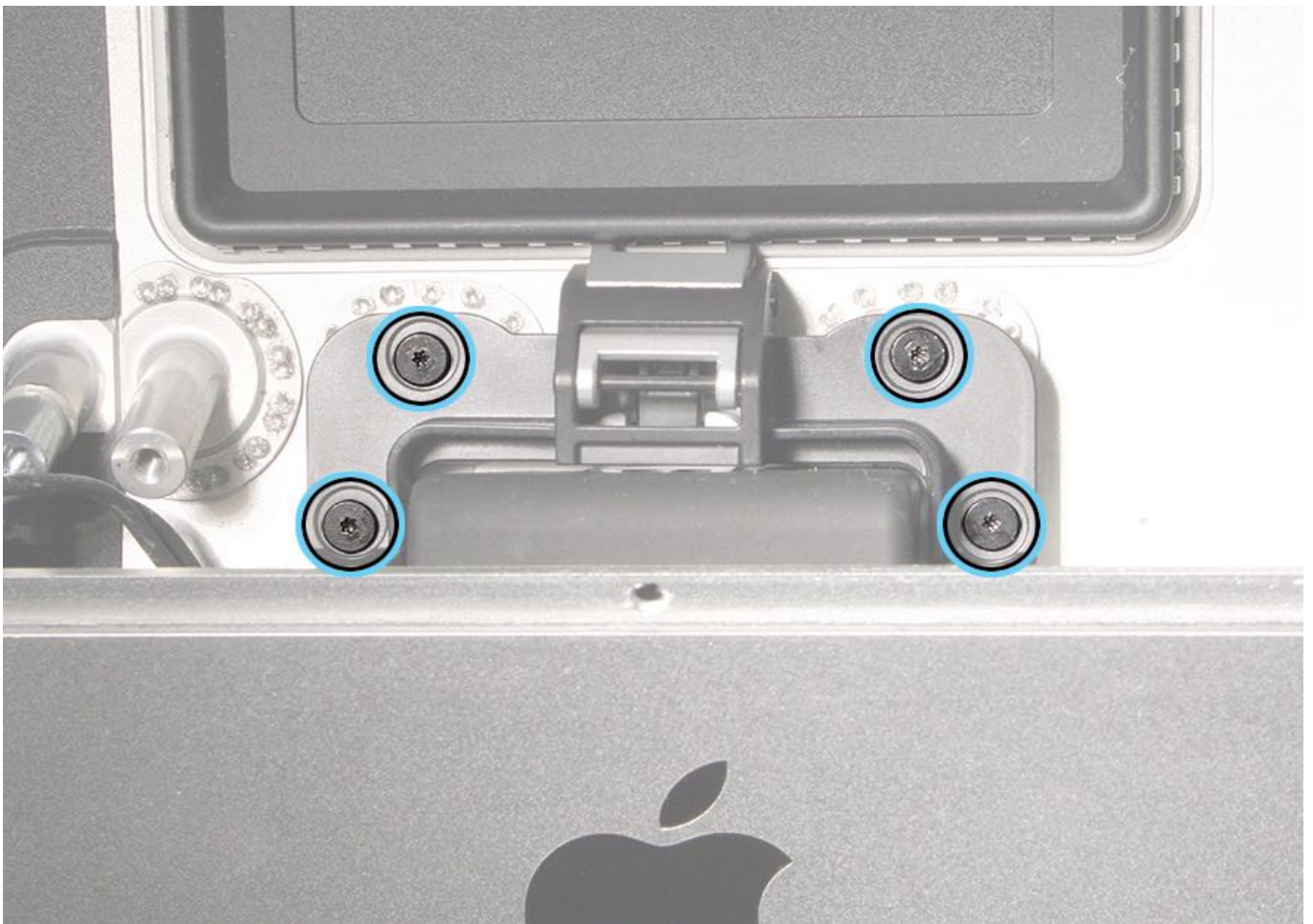
Steps For Removal

1. Remove four T5 screws.
 - T5: 923-0404, 6.5 mm
2. Lift the RAM access door lock mechanism out of the rear housing.



Steps For Reassembly

1. Insert the RAM access door into the rear housing. Line up the screw holes.
2. Install the four T5 screws.



3. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, the [Late 2015](#) model, or the [2017](#) model.
4. Reinstall the [power supply](#).
5. Reinstall the [hard drive](#).
6. Reinstall the [left speaker](#).
7. Reinstall the [right speaker](#).
8. Reinstall the [chin strap](#).
9. Reinstall the [fan](#).
10. Install new [display panel VHB strips](#).
11. Reinstall the [display panel](#).

Stand

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

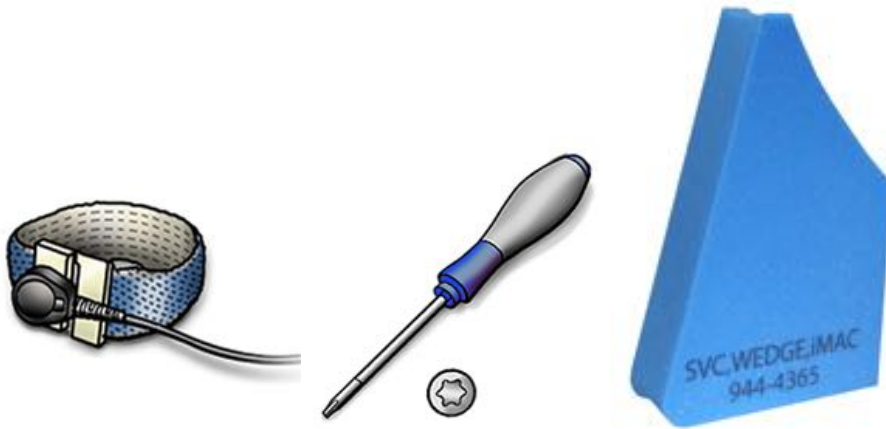
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)



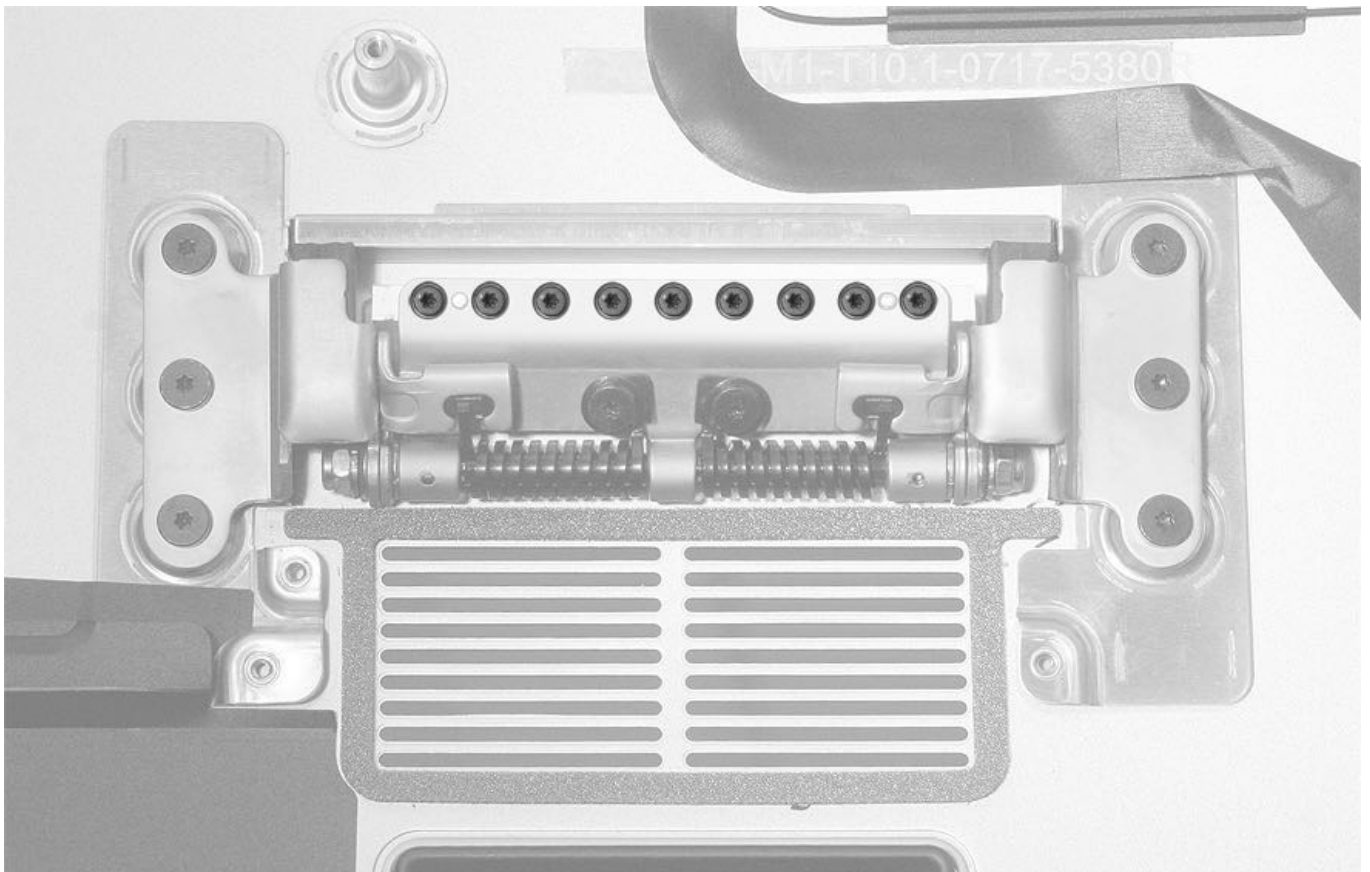
Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)
- Service wedge (iMac)



Steps For Removal

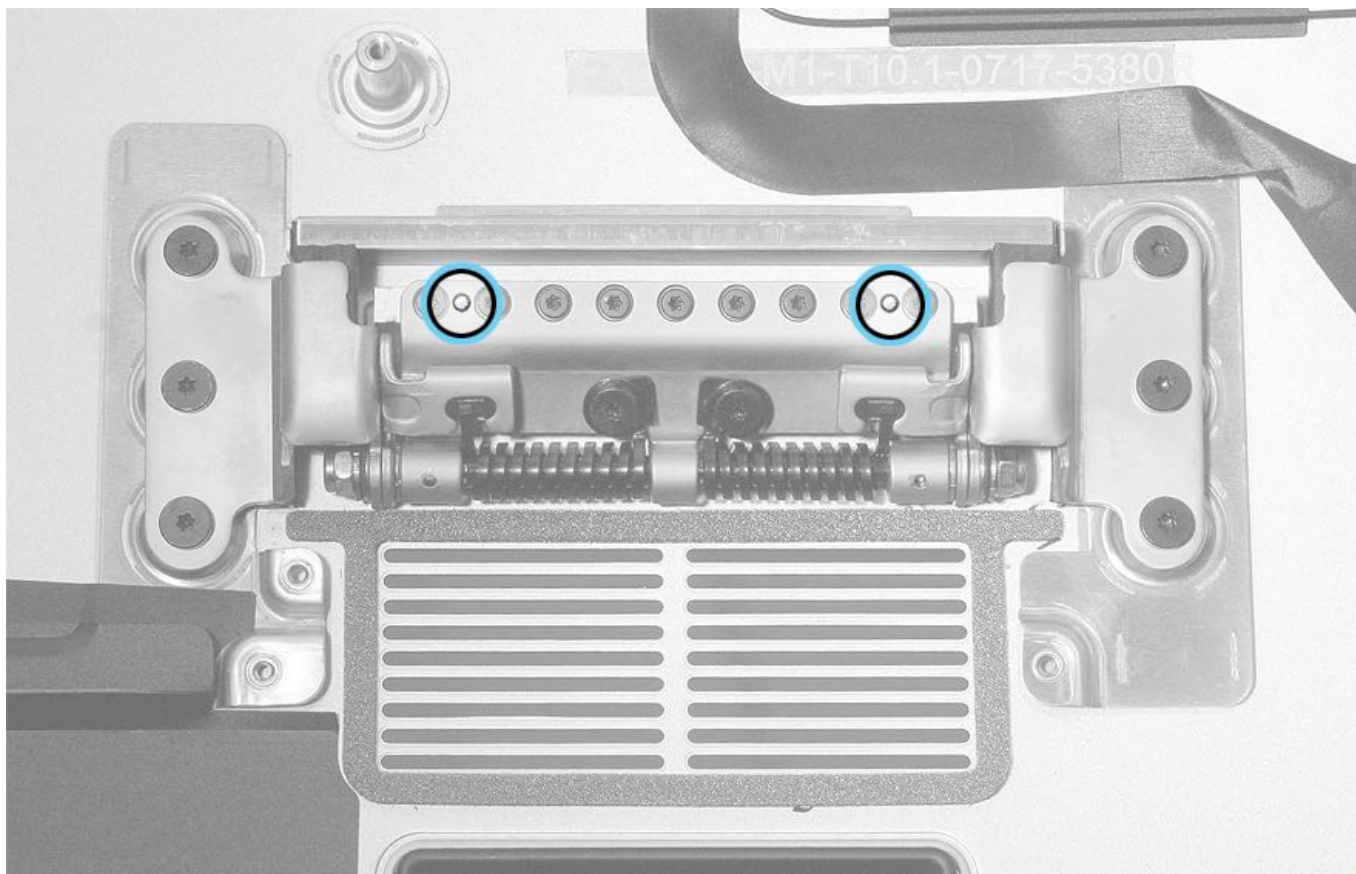
1. Remove nine T8 screws.
 - T8: 923-00529, 7.5 mm



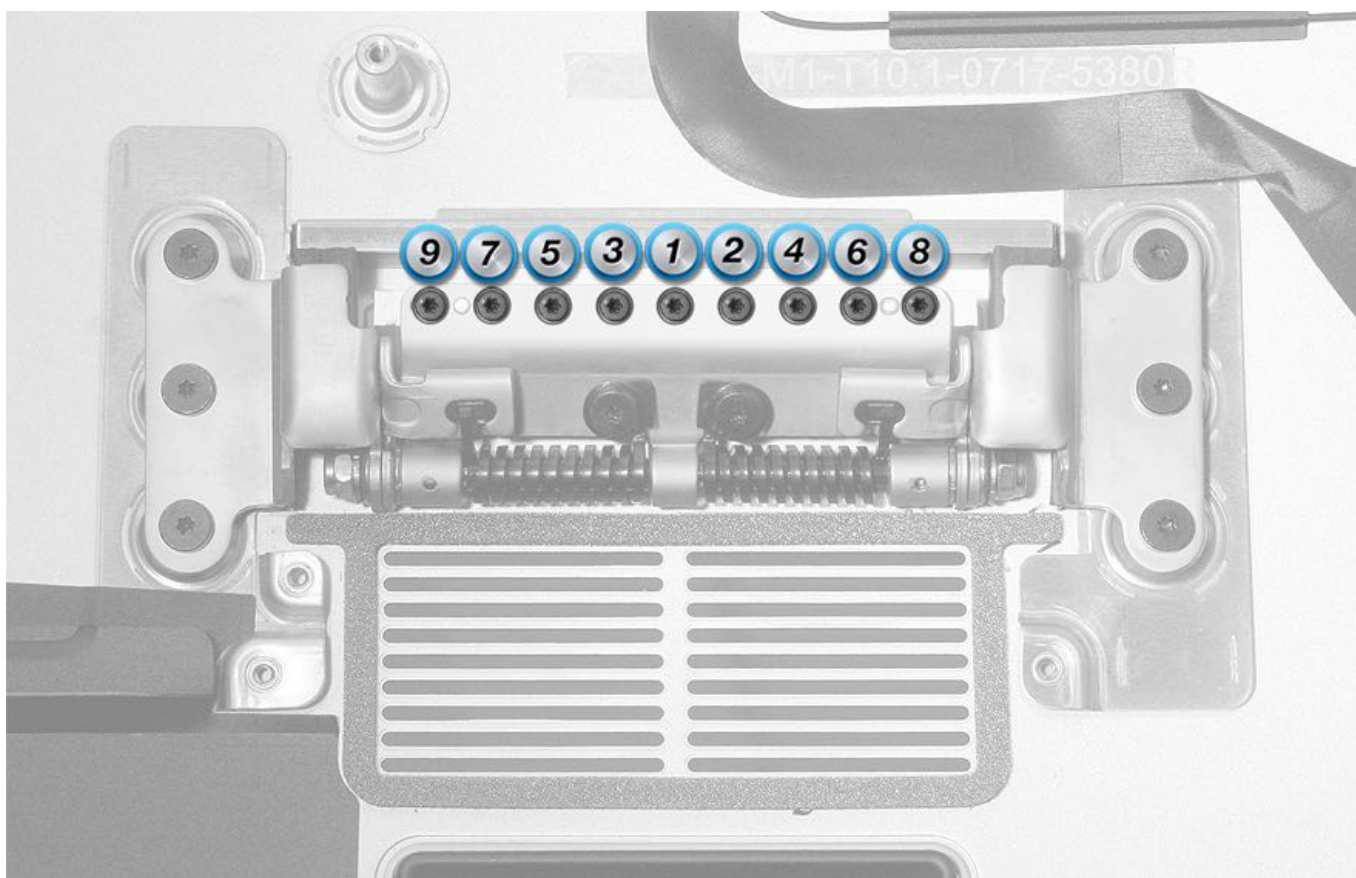
2. Lift the rear housing off of the stand, separating the stand from the mechanism.

Steps For Reassembly

1. Line up the two pins on the stand with the pin holes on the mechanism.



2. Replace the nine T8 screws in the order shown.



3. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, the [Late 2015](#) model, or the [2017](#) model.

4. Reinstall the [power supply](#).

5. Reinstall the [hard drive](#).

6. Reinstall the [left speaker](#).

7. Reinstall the [right speaker](#).
8. Reinstall the [chin strap](#).
9. Reinstall the [fan](#).
10. Install new [display panel VHB strips](#).
11. Reinstall the [display panel](#).

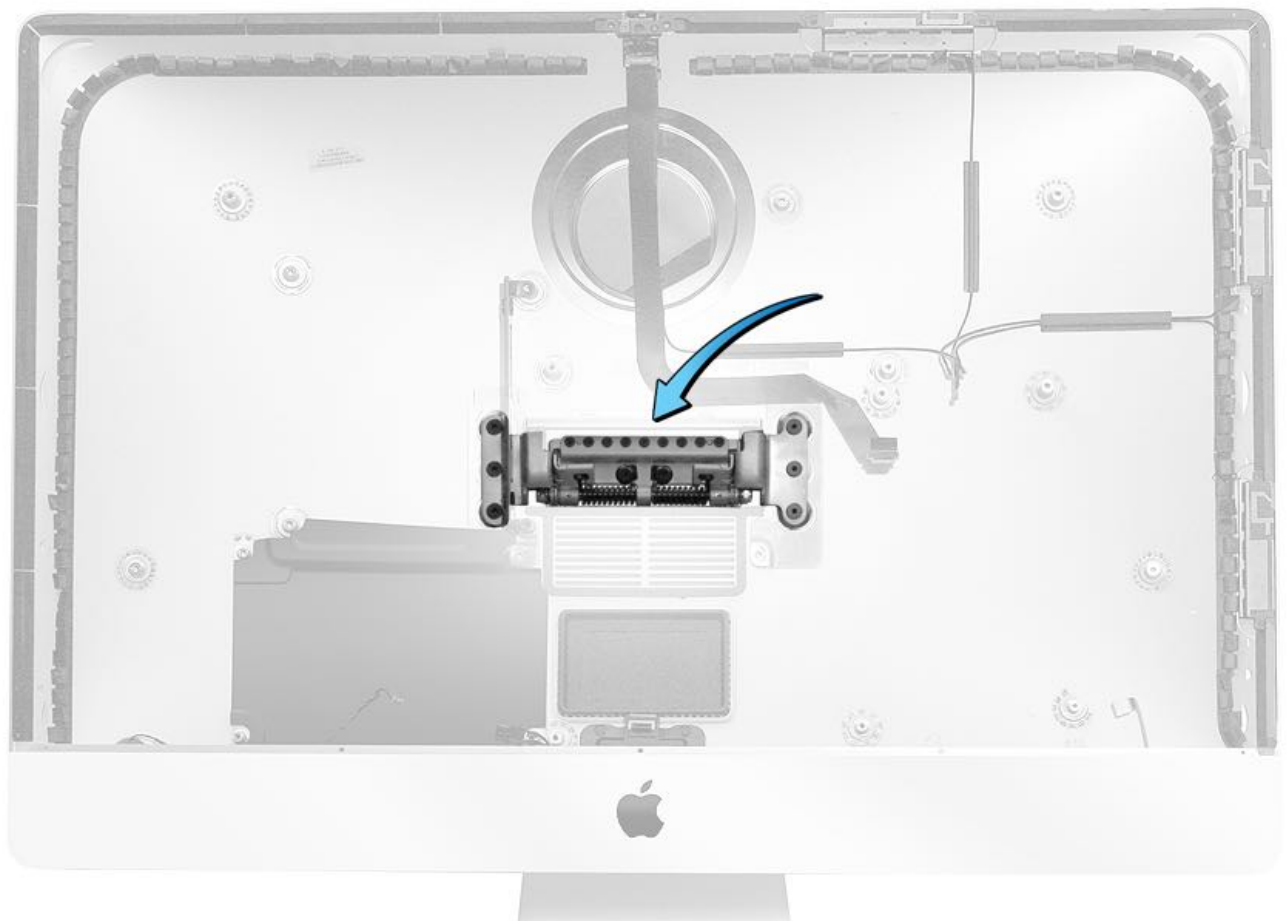
Mechanism

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

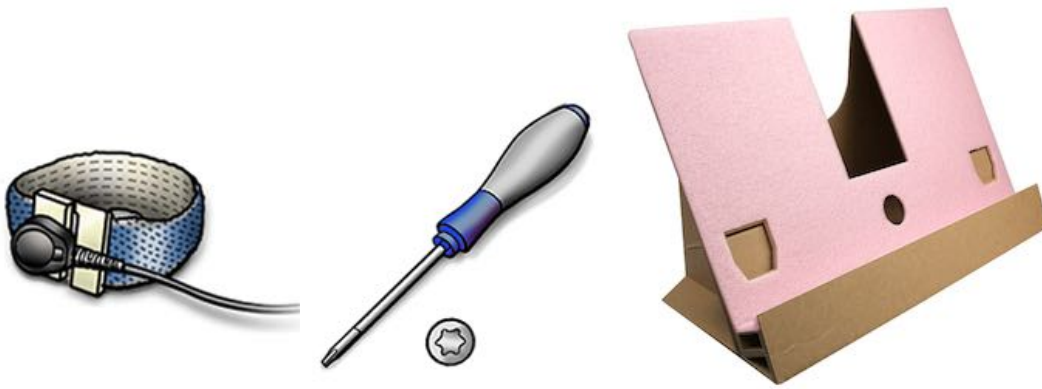
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)
- [Stand](#)



Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- LCD service support stand (923-0416)



Steps For Removal

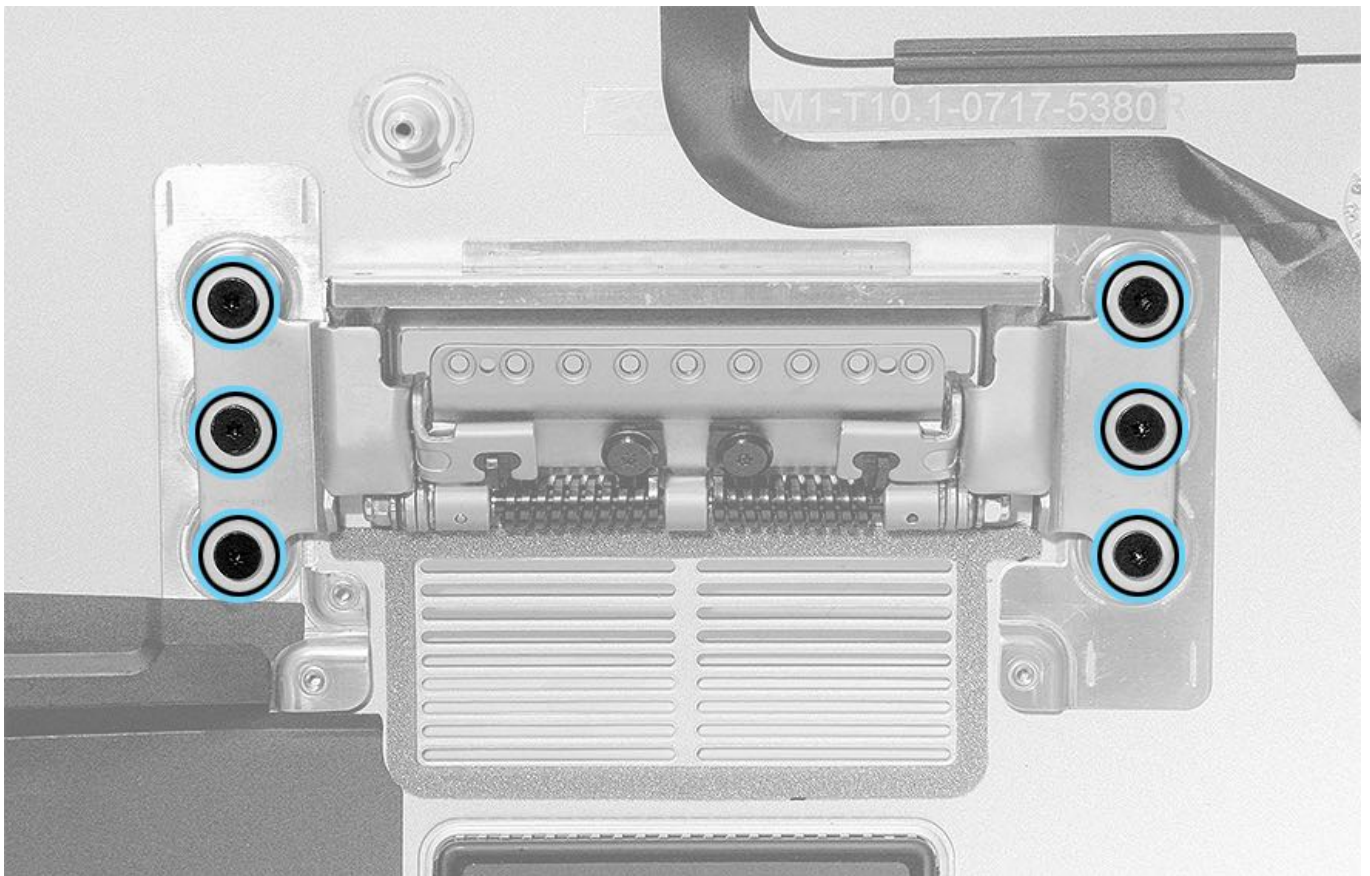
1. Place the rear housing in the LCD service support stand. Remove six T10 screws:

- T10: 923-0334, 5.8 mm



2. Lift the mechanism off of the rear housing.

Note: There is a different mechanism for the flash storage (SSD only) configuration (923-0376).

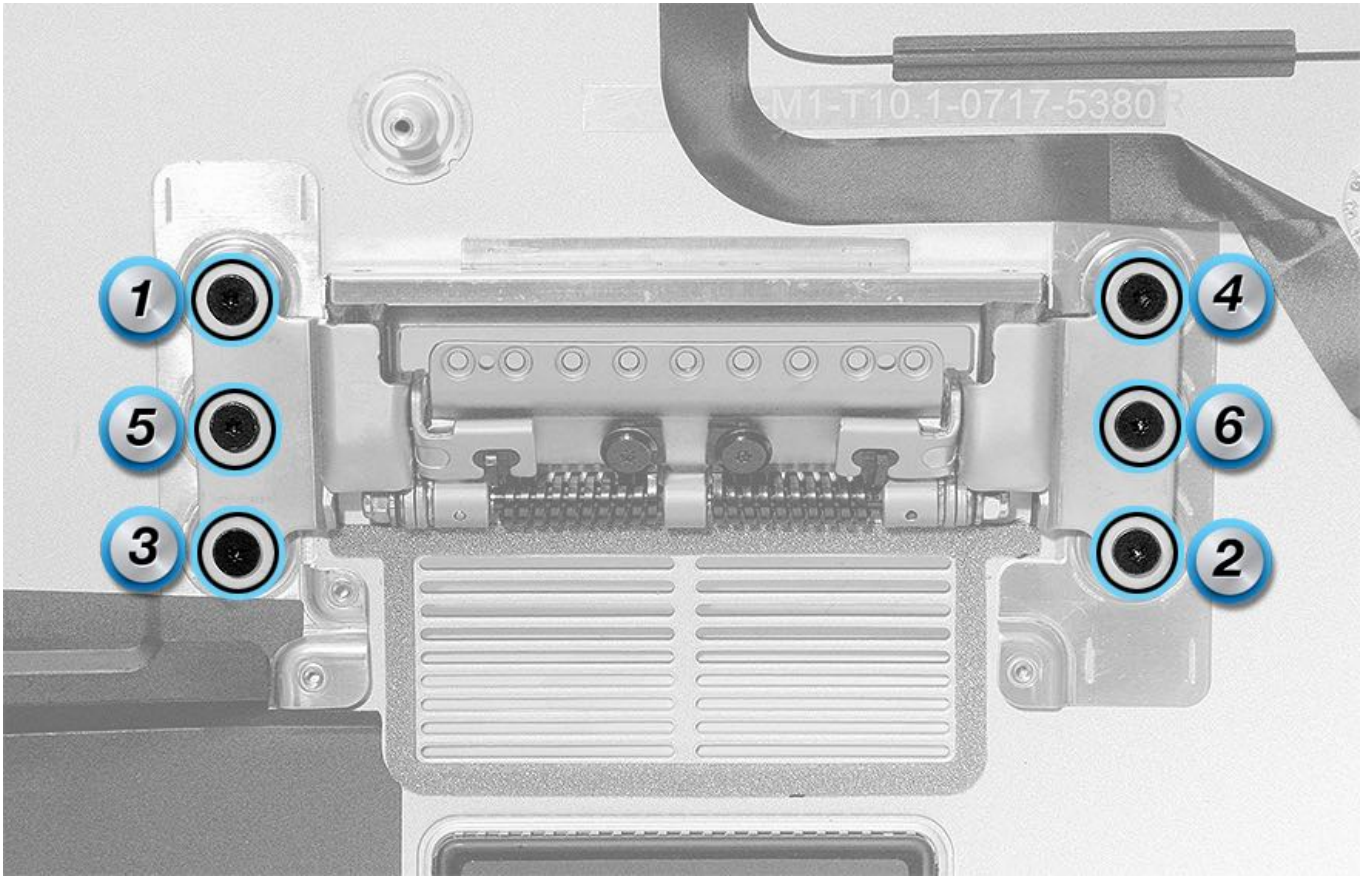


Steps For Reassembly

1. Position the mechanism in the center of the rear housing.

2. Install six T10 screws in the following order:

- T10: 923-0334, 5.8 mm



3. Reinstall the [stand](#).
4. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, the [Late 2015](#) model, or the [2017](#) model.
5. Reinstall the [power supply](#).
6. Reinstall the [hard drive](#).
7. Reinstall the [left speaker](#).
8. Reinstall the [right speaker](#).
9. Reinstall the [chin strap](#).
10. Reinstall the [fan](#).
11. Install new [display panel VHB strips](#).
12. Reinstall the [display panel](#).

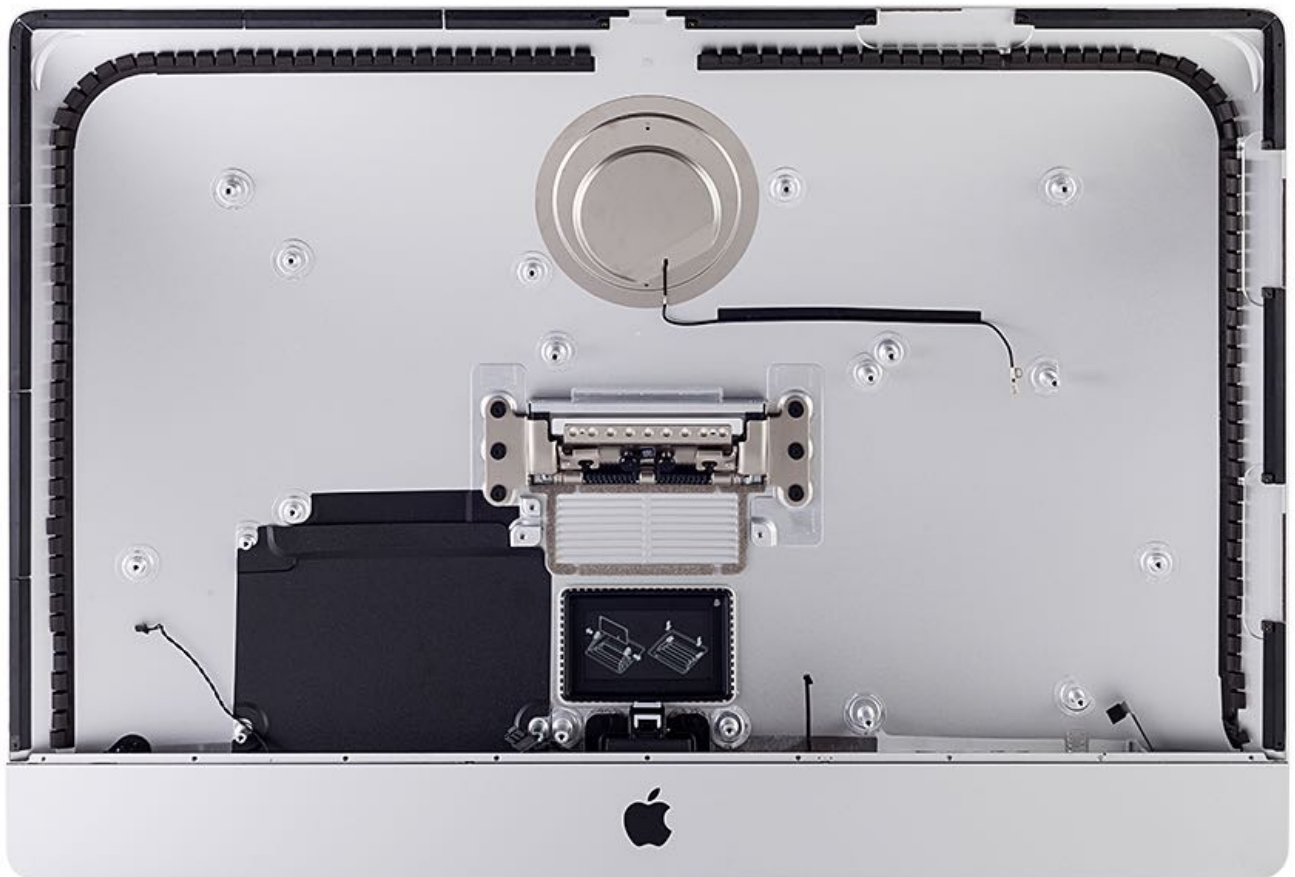
Rear Housing

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

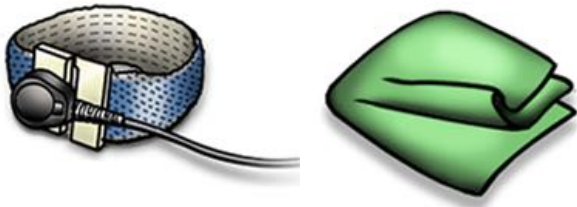
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera](#)
- [Camera cable](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Bluetooth antenna](#)
- [Middle Wi-Fi antenna](#)
- [Lower Wi-Fi antenna](#)
- [Power supply](#)
- [Logic board](#)
- [Stand](#)



Tools

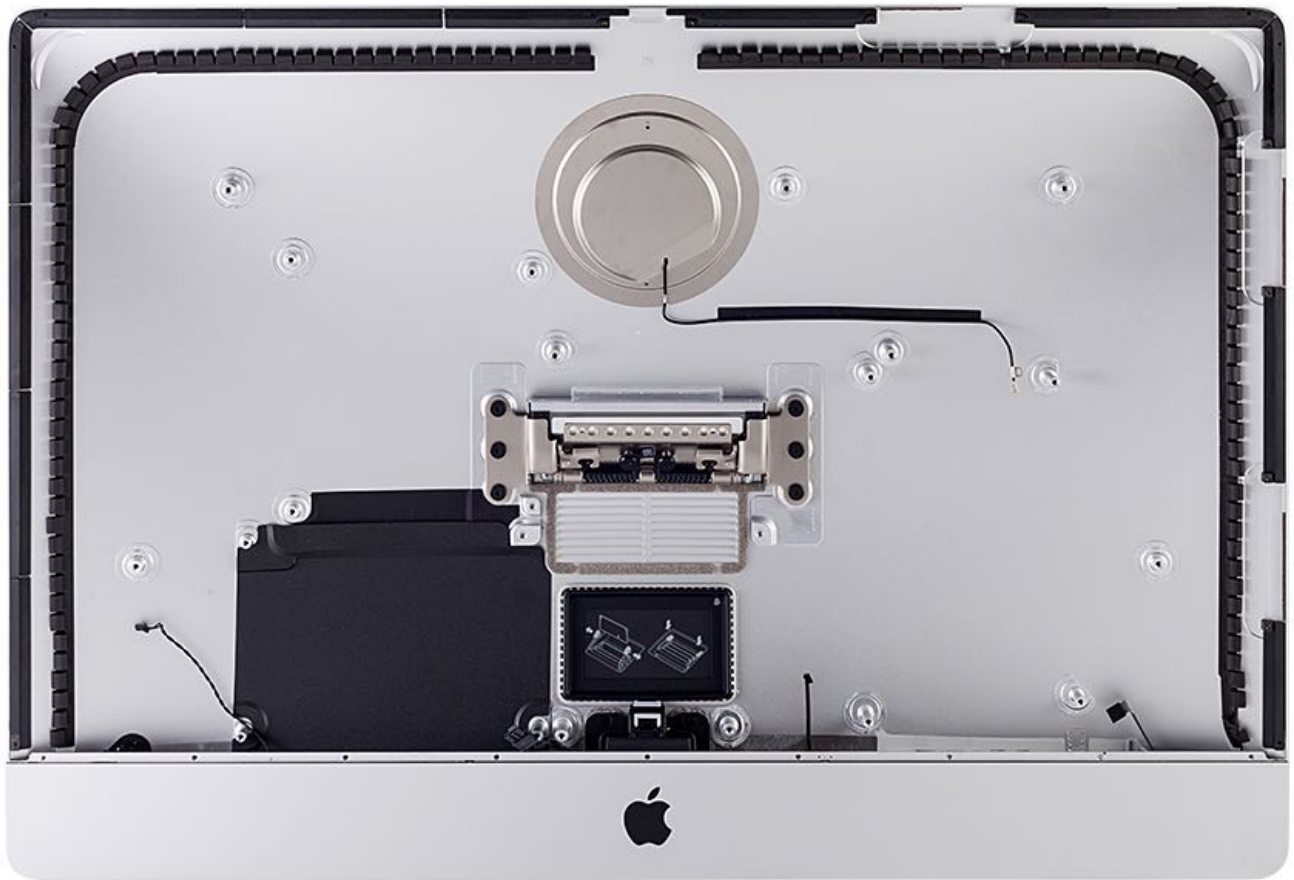
- ESD wrist strap and mat
- Lint-free cloth



Steps For Removal

When all other modules have been removed, the rear housing is the remaining part. iMac (Retina 5K, 27-inch, 2017) uses rear housing (923-01666) or VESA rear housing (923-01667).

iMac (Retina 5K, 27-inch, 2017) Rear Housing



The rear housing includes the following parts, which are also available separately:

- Mechanism (923-01734)
- Mechanism screws (923-0334)
- RAM access door (923-0554)
- RAM access door lock mechanism (923-00658)
- RAM access door lock mechanism screws (923-0404)
- 9-hole chin strap (923-0528)
- Chin strap screws (923-0338), package of 9
- T25 PSU standoff (923-0520)
- T25 HDD standoff (923-0521)

The rear housing includes the following parts, which are **not** available separately:

- Wi-Fi antenna (in silver circle behind Apple logo)
- Microphone flex cable
- Power button and cable
- Audio cable
- AC inlet
- Gaskets

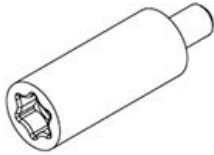
- Wireless antenna insulator tape

Steps For Reassembly

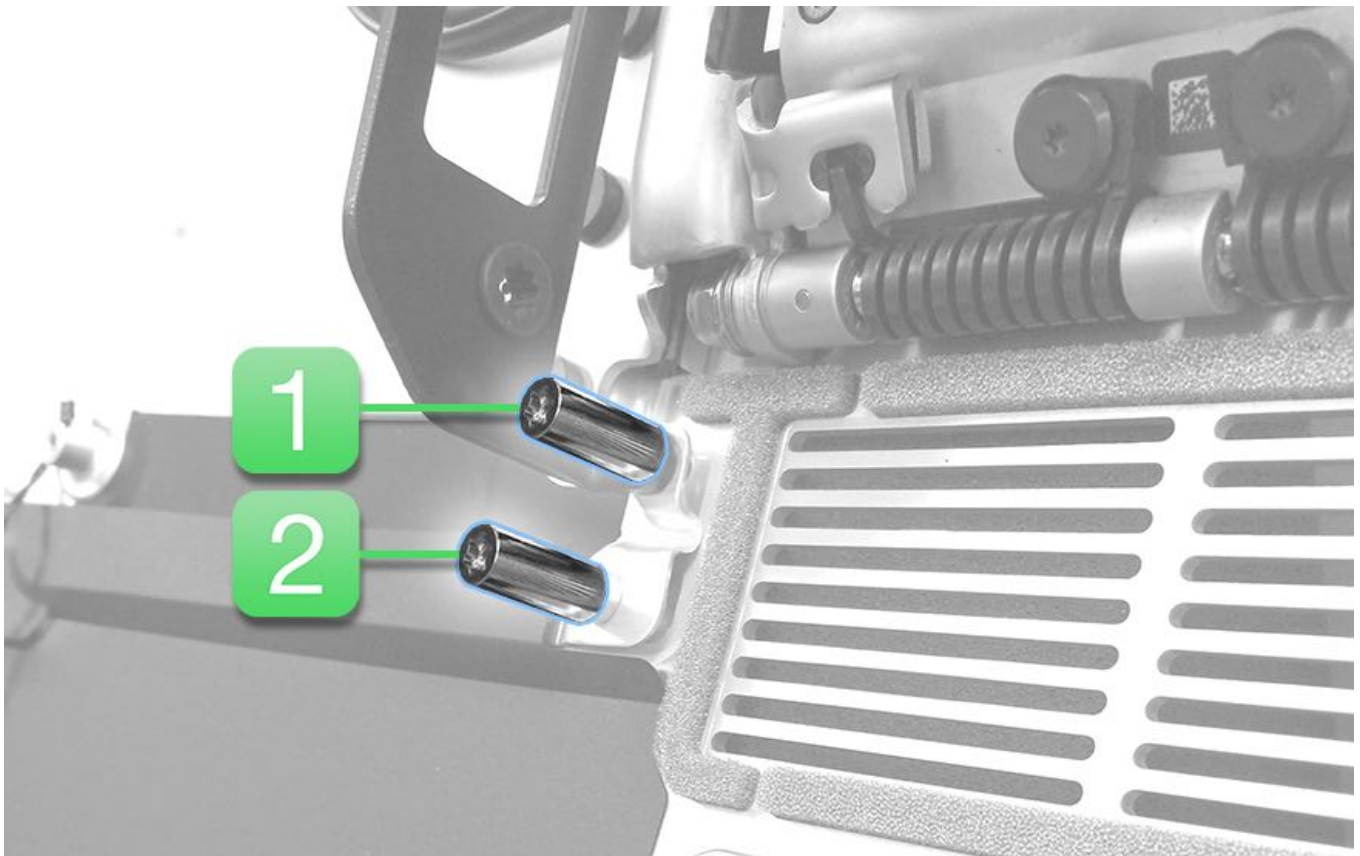
1. If you are replacing a rear housing, transfer standoffs (#1 and #2) **and** the left and right hard drive brackets (black, metal brackets that support the hard drive) to the replacement rear housing, then proceed to step 3.

Tip: If you have to step away from the repair, screw the standoffs to the rear housing so they do not get lost or mixed up on the repair bench.

- #1: Hard drive standoff, 923-0521



- #2: Power supply standoff, 923-0520



2. Transfer the Bluetooth antenna (upper antenna) and two Wi-Fi antennas (middle and lower antennas) to the rear housing.

3. Route the antennas under the insulator tape or Mylar tape.

Note: If the insulator tape or Mylar tape no longer adheres to the rear housing, use Kapton tape to secure the antennas.

4. Reinstall the [stand](#).

5. Reinstall the [logic board](#).

6. Reinstall the [power supply](#).

7. Reinstall the [hard drive](#).

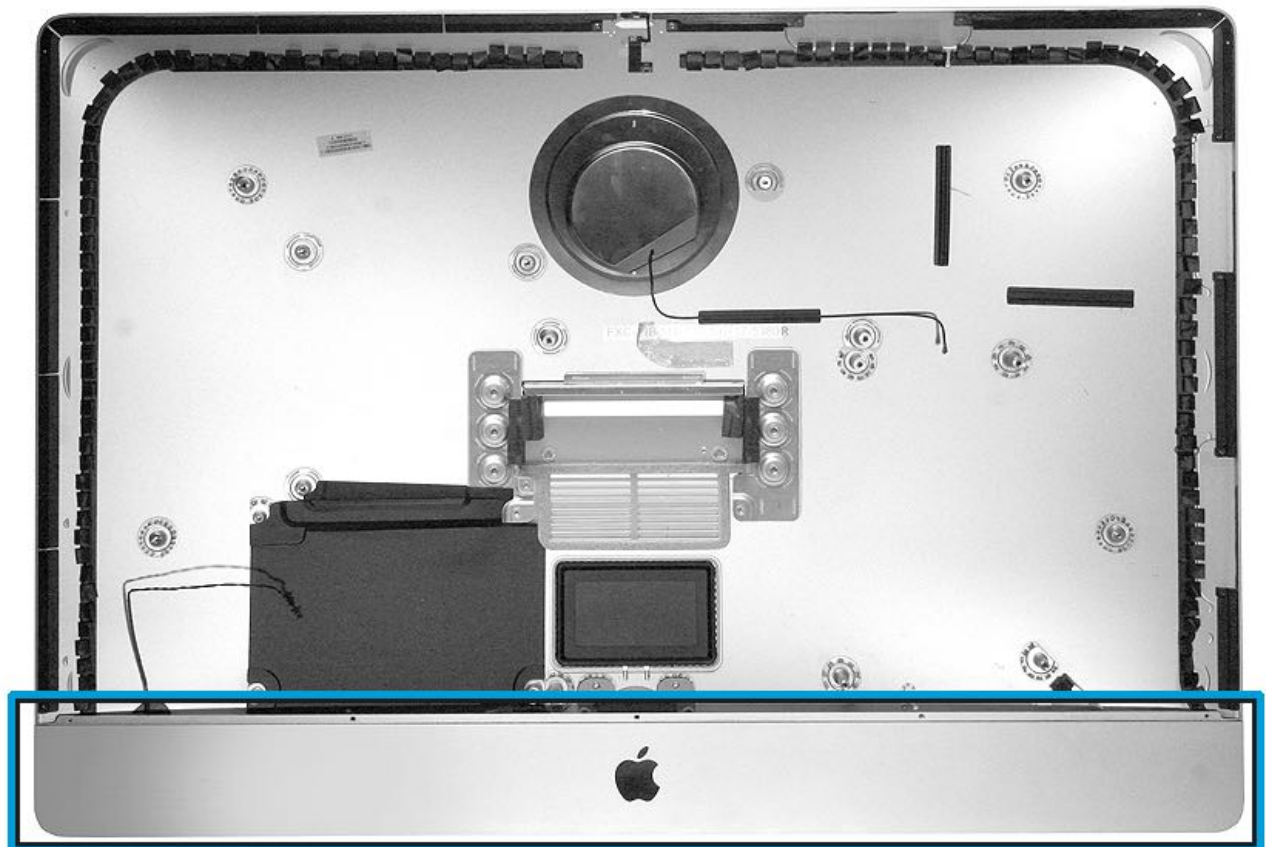
8. Reinstall the [left speaker](#).

9. Reinstall the [right speaker](#).

10. Reinstall the [chin strap](#).
11. Reinstall the [camera cable](#).
12. Reinstall the [camera](#).
13. Reinstall the [fan](#).
14. Install new [display panel VHB strips](#).
15. Reinstall the [display panel](#).

Handling the Rear Housing

Always handle the rear housing with two hands in the lower left and right corners. Never carry the rear housing with a single hand, or by holding the aluminum chin (where the Apple logo appears on the lower front).



VESA Mount Adapter

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

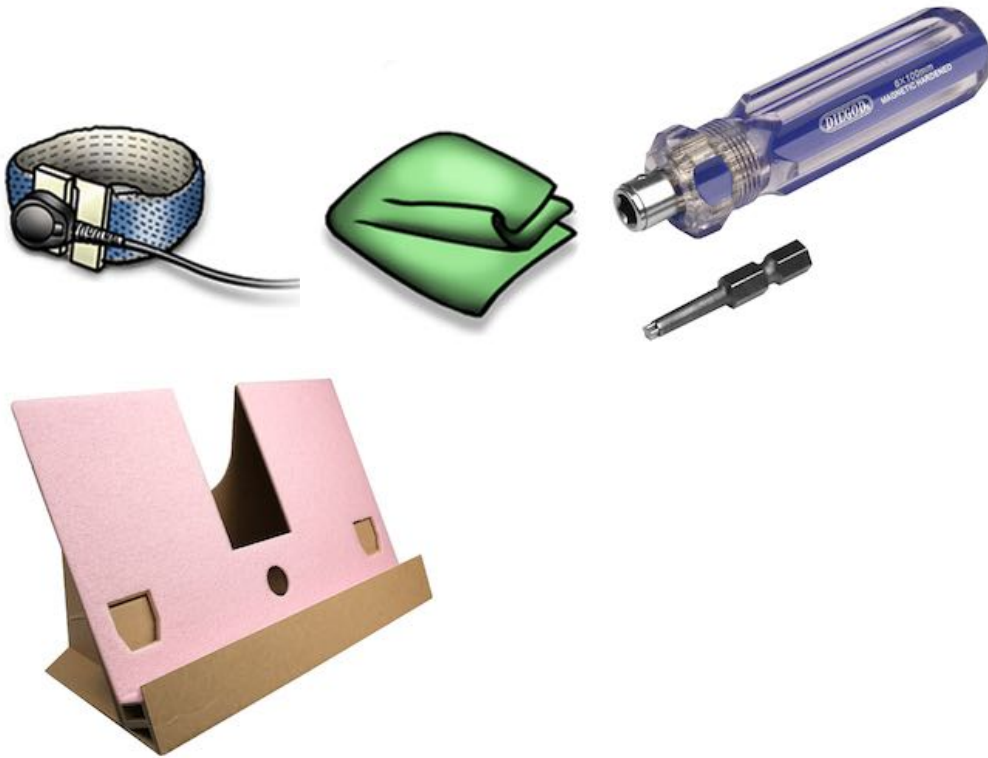
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera/microphone cable \(disconnect from logic board\)](#) (Late 2012 to Late 2015)
- [Camera cable \(disconnect from logic board\)](#) (2017)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Disconnect Bluetooth antenna](#) (Late 2012 to Mid 2015)
- [Disconnect Bluetooth antenna](#) (Late 2015)
- [Disconnect Bluetooth antenna](#) (2017)
- [Disconnect middle Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect middle Wi-Fi antenna](#) (Late 2015)
- [Disconnect middle Wi-Fi antenna](#) (2017)
- [Disconnect lower Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect lower Wi-Fi antenna](#) (Late 2015)
- [Disconnect lower Wi-Fi antenna](#) (2017)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)



Tools

- ESD wrist strap and mat
- Lint-free cloth

- VESA pentalobe driver (923-0367)
- LCD Service Support Stand (923-0416)

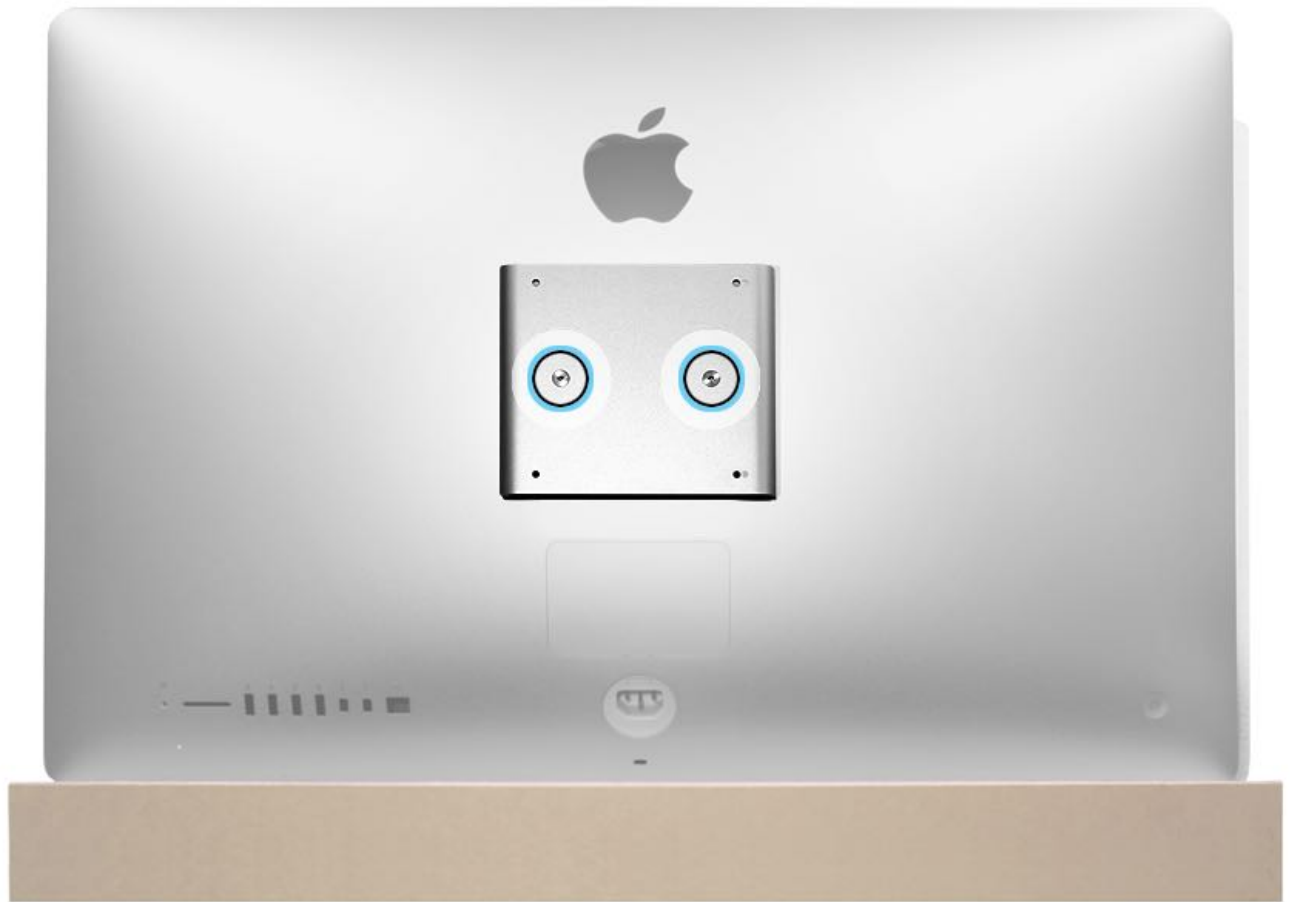


Steps For Removal

1. Place rear housing on LCD support stand, with the VESA mount adapter facing you.
2. Remove two pentalobe screws.
 - VESA Pentalobe: 923-0418

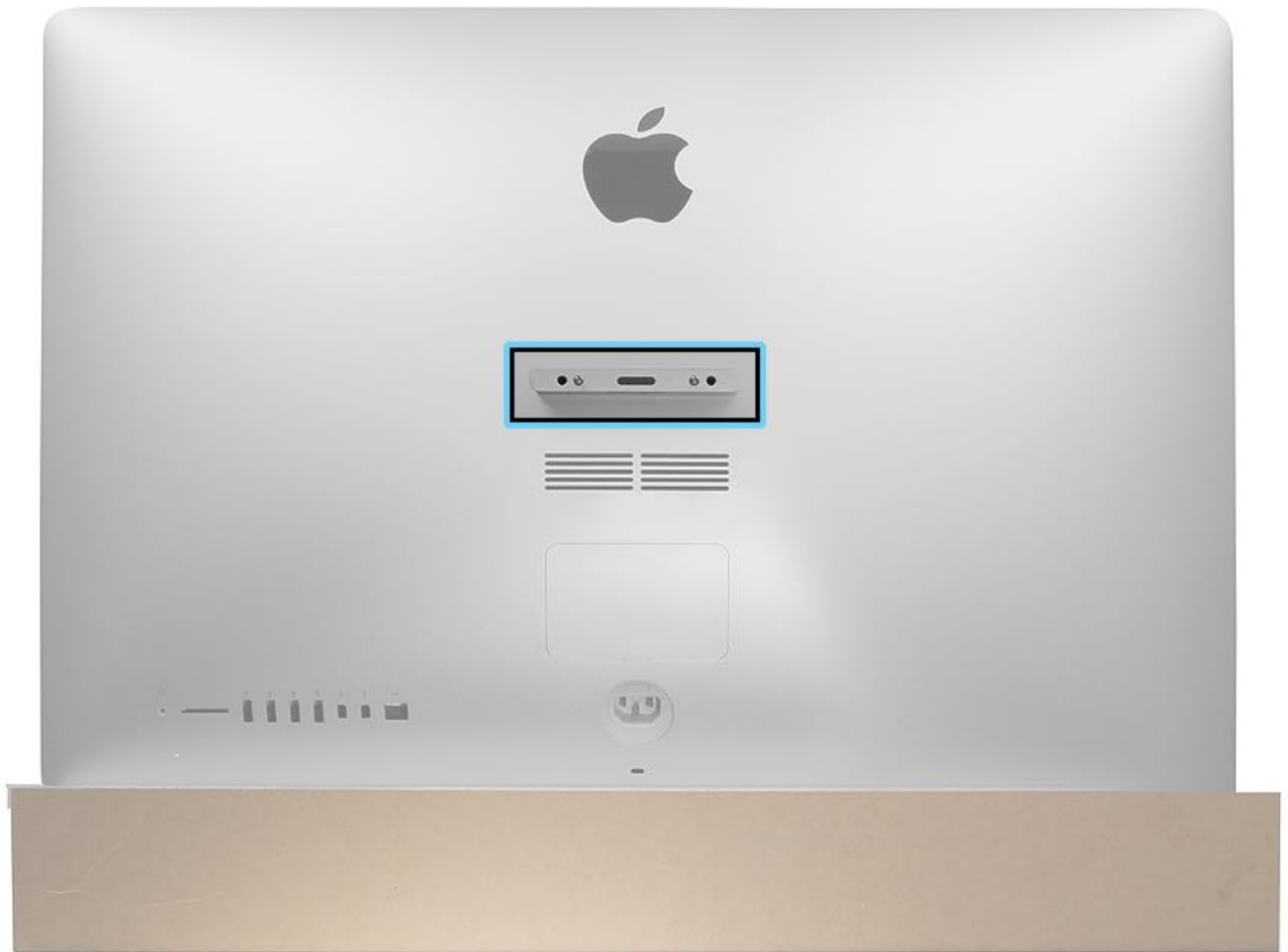


3. Lift the VESA mount adapter off the rear housing.



Steps For Reassembly

1. Insert the VESA tongue into the opening on the rear housing (if removed).

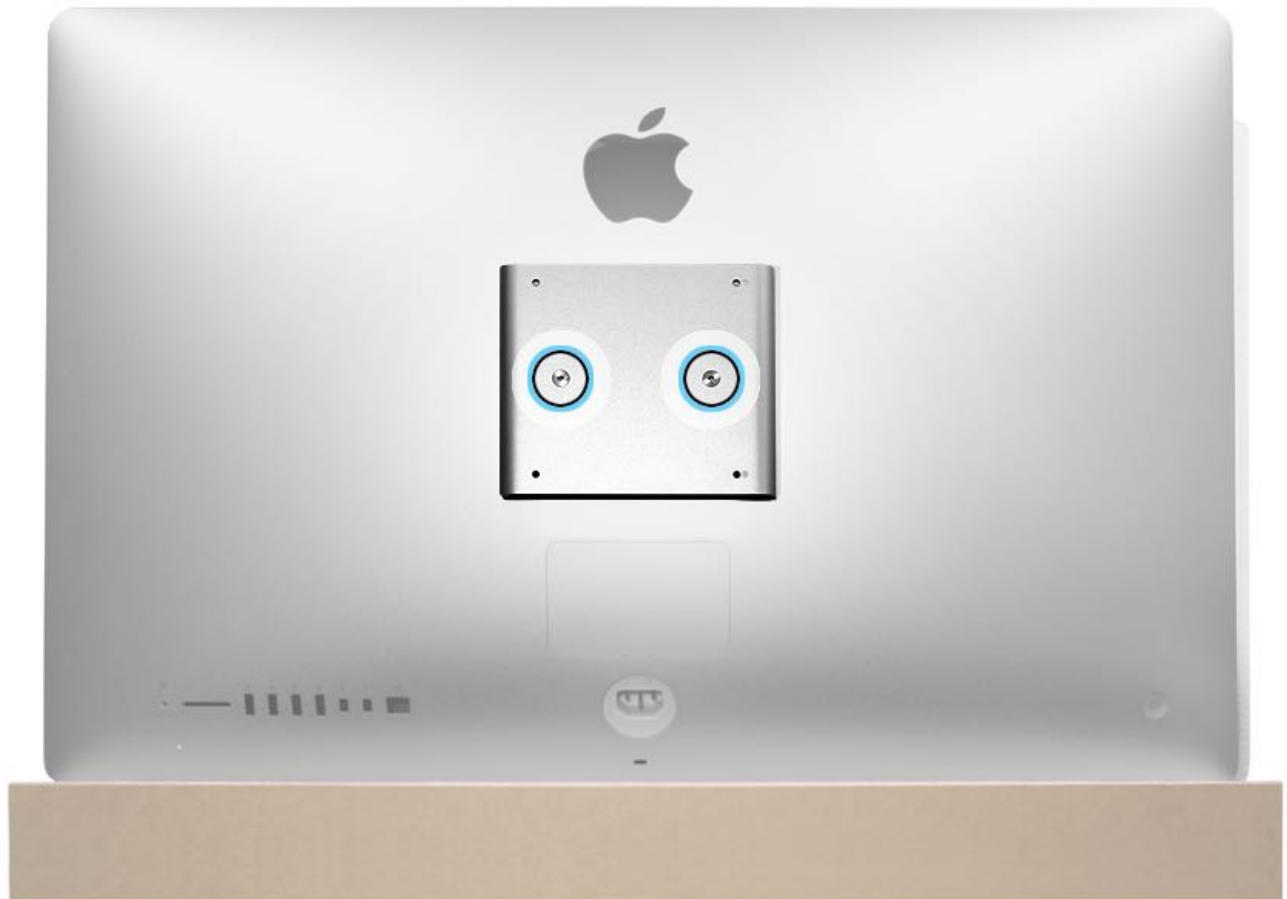


2. Place the VESA mount adapter over the VESA tongue, lining up the screw holes.

3. Install two pentalobe screws.

- VESA Pentalobe: 923-0418





4. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
5. Reinstall the [power supply](#).
6. Connect the lower Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
7. Connect the middle Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
8. Connect the upper Bluetooth antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
9. Reinstall the [hard drive](#).
10. Reinstall the [left speaker](#).
11. Reinstall the [right speaker](#).
12. Reinstall the [chin strap](#).
13. Connect the [camera/microphone cable](#) (Late 2012 to Late 2015) or [camera cable](#) (2017) to the logic board.
14. Reinstall the [fan](#).
15. Install new [display panel VHB strips](#).
16. Reinstall the [display panel](#).

VESA Tongue

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

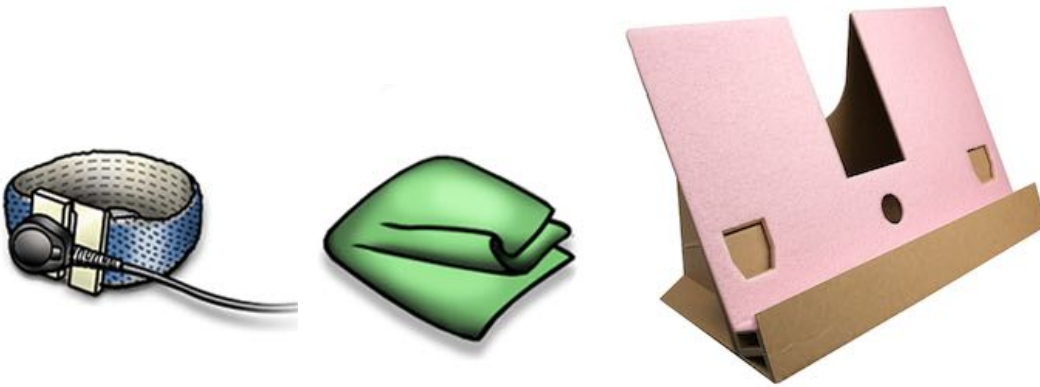
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera/microphone cable \(disconnect from logic board\)](#) (Late 2012 to Late 2015)
- [Camera cable \(disconnect from logic board\)](#) (2017)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Disconnect Bluetooth antenna](#) (Late 2012 to Mid 2015)
- [Disconnect Bluetooth antenna](#) (Late 2015)
- [Disconnect Bluetooth antenna](#) (2017)
- [Disconnect middle Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect middle Wi-Fi antenna](#) (Late 2015)
- [Disconnect middle Wi-Fi antenna](#) (2017)
- [Disconnect lower Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect lower Wi-Fi antenna](#) (Late 2015)
- [Disconnect lower Wi-Fi antenna](#) (2017)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)
- [VESA mount adapter](#)



Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD Service Support Stand (923-0416)



Steps For Removal

1. Place the rear housing on the LCD support stand, with the VESA tongue facing you.
2. Pull the VESA tongue off of the rear housing. **Note:** The computer serial number is on the underside of the VESA tongue.

Steps For Reassembly

1. Insert the VESA tongue into the opening on the rear housing.



2. Reinstall the [VESA mount adapter](#).
3. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.

4. Reinstall the [power supply](#).
5. Connect the lower Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
6. Connect the middle Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
7. Connect the upper Bluetooth antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
8. Reinstall the [hard drive](#).
9. Reinstall the [left speaker](#).
10. Reinstall the [right speaker](#).
11. Reinstall the [chin strap](#).
12. Connect the [camera/microphone cable](#) (Late 2012 to Late 2015) or [camera cable](#) (2017) to the logic board.
13. Reinstall the [fan](#).
14. Install new [display panel VHB strips](#).
15. Reinstall the [display panel](#).

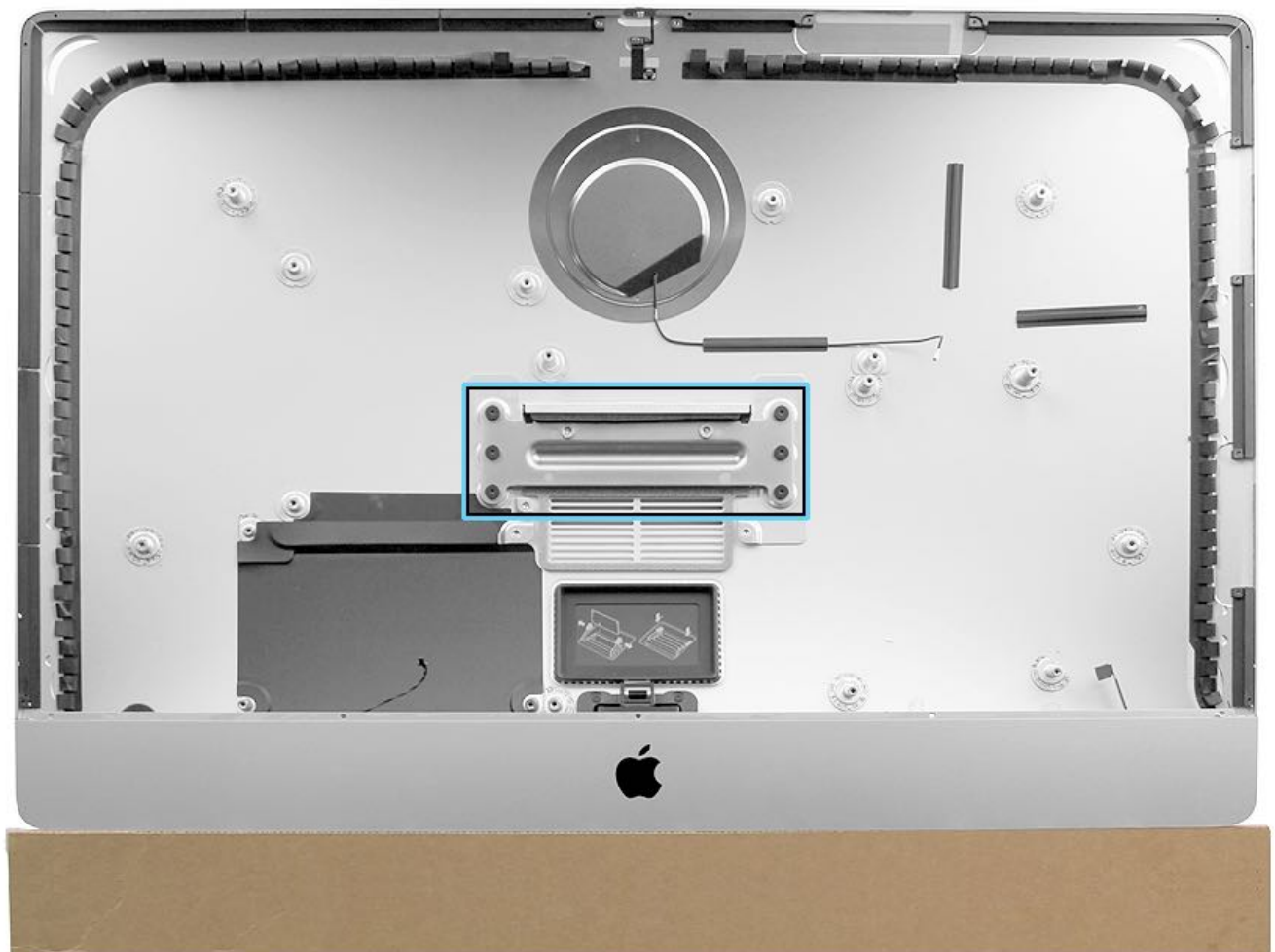
VESA Mechanism Plate

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera/microphone cable \(disconnect from logic board\)](#) (Late 2012 to Late 2015)
- [Camera cable \(disconnect from logic board\)](#) (2017)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Disconnect Bluetooth antenna](#) (Late 2012 to Mid 2015)
- [Disconnect Bluetooth antenna](#) (Late 2015)
- [Disconnect Bluetooth antenna](#) (2017)
- [Disconnect middle Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect middle Wi-Fi antenna](#) (Late 2015)
- [Disconnect middle Wi-Fi antenna](#) (2017)
- [Disconnect lower Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect lower Wi-Fi antenna](#) (Late 2015)
- [Disconnect lower Wi-Fi antenna](#) (2017)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)
- [VESA mount adapter](#)
- [VESA tongue](#)



Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD service support stand (923-0416)
- Torx T10 screwdriver



Steps For Removal

1. Place the rear housing on the LCD support stand, with the VESA mechanism plate facing you.
2. Remove six T10 screws.
 - T10: 923-0334



3. Lift the VESA mechanism plate off of the rear housing.



Steps For Reassembly

1. Position the mechanism plate in the rear housing.
2. Reinstall the six T10 screws.
 - T10: 923-0334





3. Reinstall the [VESA tongue](#).
4. Reinstall the [VESA mount adapter](#).
5. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
6. Reinstall the [power supply](#).
7. Connect the lower Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
8. Connect the middle Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
9. Connect the upper Bluetooth antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
10. Reinstall the [hard drive](#).
11. Reinstall the [left speaker](#).
12. Reinstall the [right speaker](#).
13. Reinstall the [chin strap](#).
14. Connect the [camera/microphone cable](#) (Late 2012 to Late 2015) or [camera cable](#) (2017) to the logic board.
15. Reinstall the [fan](#).
16. Install new [display panel VHB strips](#).
17. Reinstall the [display panel](#).

VESA Rear Housing

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

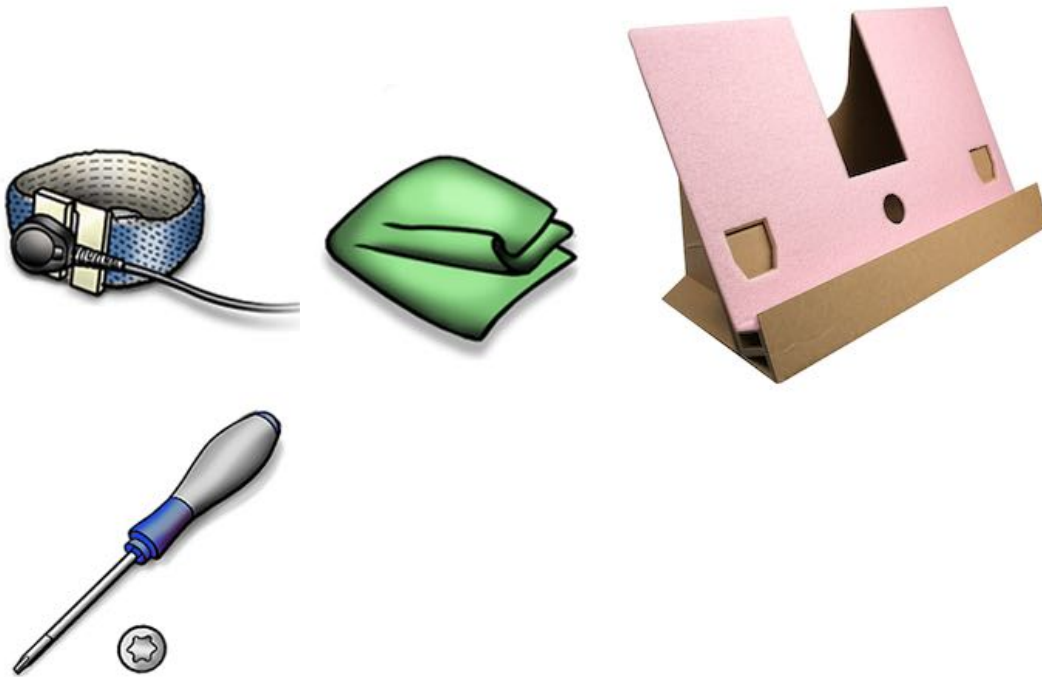
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera/microphone cable \(disconnect from logic board\)](#) (Late 2012 to Late 2015)
- [Camera cable \(disconnect from logic board\)](#) (2017)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Disconnect Bluetooth antenna](#) (Late 2012 to Mid 2015)
- [Disconnect Bluetooth antenna](#) (Late 2015)
- [Disconnect Bluetooth antenna](#) (2017)
- [Disconnect middle Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect middle Wi-Fi antenna](#) (Late 2015)
- [Disconnect middle Wi-Fi antenna](#) (2017)
- [Disconnect lower Wi-Fi antenna](#) (Late 2012 to Mid 2015)
- [Disconnect lower Wi-Fi antenna](#) (Late 2015)
- [Disconnect lower Wi-Fi antenna](#) (2017)
- [Power supply](#)
- [Logic board](#) (Late 2012 to Mid 2015)
- [Logic board](#) (Late 2015)
- [Logic board](#) (2017)
- [VESA mount adapter](#)
- [VESA tongue](#)



Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD service support stand (923-0416)
- Torx T10 screwdriver
- Torx T8 screwdriver
- Torx T4 screwdriver



Steps For Removal

1. Place the computer on the LCD service support stand to remove all modules listed above.
2. With all modules removed, the rear housing is the remaining part.

- 923-0552: VESA rear housing for Late 2012 and Late 2013 models.

Note: The original VESA rear housing 923-0426, which has five screw holes on the chin (see below), was replaced by VESA rear housing (923-0552), which has nine screw holes on the chin.

- 923-00082: VESA rear housing for iMac (Retina 5K, 27-inch, Late 2014 and Mid 2015)
- 923-00651: VESA rear housing for iMac (Retina 5K, 27-inch, Late 2015)
- 923-01667: VESA rear housing for iMac (Retina 5K, 27-inch, 2017)

A VESA rear housing includes the following parts, which are **not** available separately:

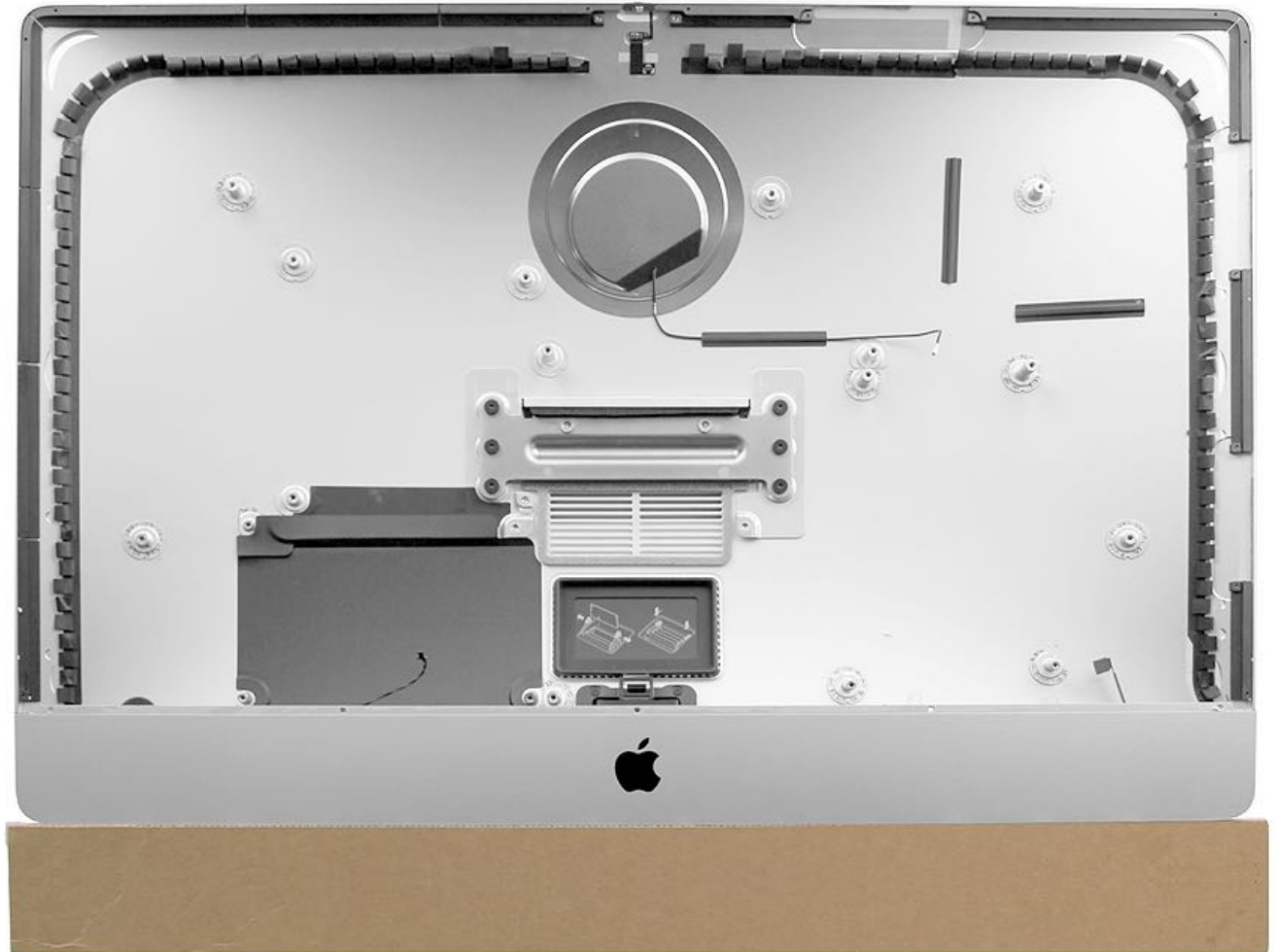
- Wi-Fi antenna in silver circle behind Apple logo
- microphone (attached at the top of the rear housing for Late 2012 to Late 2015 models)
- microphone flex cable (attached inside chin of the rear housing for the 2017 model)
- power button and cable
- AC inlet
- audio input/output cable
- gaskets
- wireless antenna insulators

A VESA rear housing includes the following parts, which are available separately:

- RAM access door (923-0554)
- RAM access door lock mechanism (923-0553)
- RAM access door lock mechanism screws (923-0404)
- VESA mechanism plate (923-0532)
- VESA mechanism plate (923-00657) Late 2015 only
- VESA mechanism plate screws (923-0334)
- VESA screws (923-0418)
- 9-hole chin strap (923-0528)
- 9 chin strap screws (923-0338)
- T25 PSU standoff (923-0520), use only with 9-hole chin strap / rear housing (923-0552)

- T25 HDD standoff (923-0521), use only with 9-hole chin strap / rear housing (923-0552)

Original VESA Rear Housing (923-0426, 5-hole chin strap)



Steps For Reassembly

Caution: Always handle the rear housing with two hands in the lower left and right corners. Handling the rear housing incorrectly could flex the aluminum and cause alignment issues. Never carry the rear housing with a single hand and do not push in or pull out on the chin.

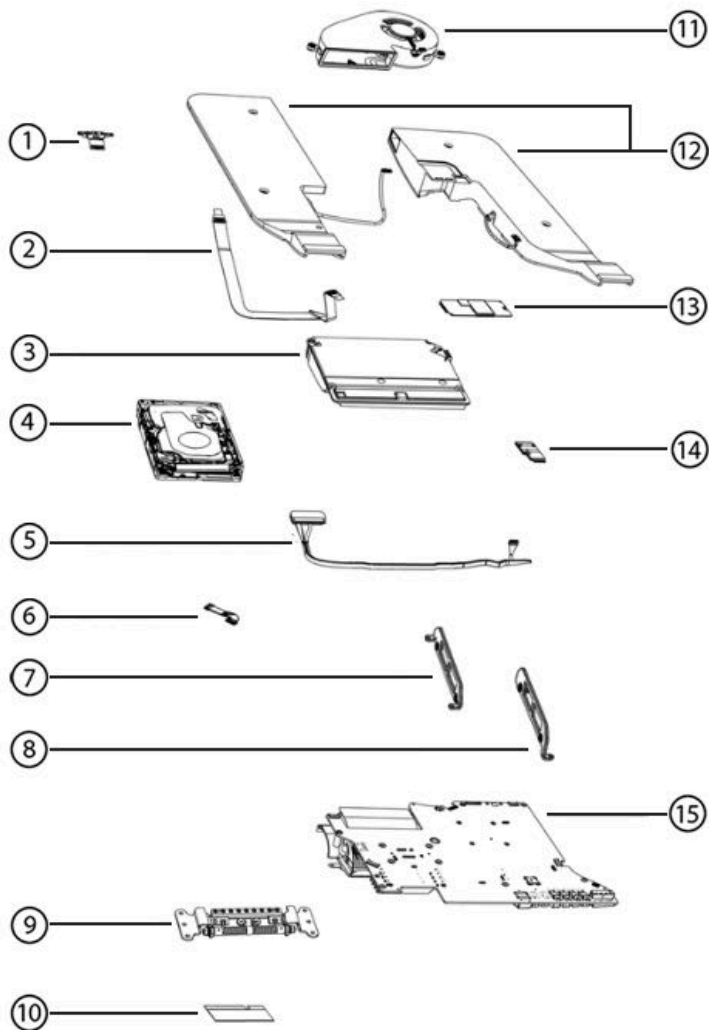
1. Transfer the Bluetooth and Wi-Fi antennas to the rear housing.
2. Press the Mylar tape on the Bluetooth and Wi-Fi antennas onto the rear housing.
3. Transfer the hard drive brackets.
4. Reinstall the [VESA tongue](#).
5. Reinstall the [VESA mount adapter](#).
6. Reinstall the logic board for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
7. Reinstall the [power supply](#).
8. Connect the lower Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
9. Connect the middle Wi-Fi antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
10. Connect the upper Bluetooth antenna for [Late 2012 to Mid 2015](#) models, for the [Late 2015](#) model, or for the [2017](#) model.
11. Reinstall the [hard drive](#).
12. Reinstall the [left speaker](#).
13. Reinstall the [right speaker](#).

-
14. Reinstall the [chin strap](#).
 15. Connect the [camera cable](#) (Late 2012 to Late 2015) or [camera cable](#) (2017) to the logic board.
 16. Reinstall the [fan](#).
 17. Install new [display panel VHB strips](#).
 18. Reinstall the [display panel](#).

Exploded View

Exploded Views for iMac (Retina 5K, 27-inch, 2017)

Exploded View 1



1. Camera

- 923-001680

2. Cable, Camera

- 923-01676

3. Power Supply, 300W

- 661-03524

4. Hard Drive

- 661-07306, 1TB
- 661-07307, 2TB
- 661-07308, 3TB

5. Hard Drive Data and Power Cable

- 923-00664

6. PSU Signal Cable

- 923-0311

7. Hard Drive Carrier Frame, Left

- 923-00086

8. Hard Drive Carrier Frame, Right

- 923-00087

9. Mechanism

- 923-01734

10. Memory, SDRAM

- 661-07301, 4GB, DDR4, 2400
- 661-07302, 8GB, DDR4, 2400
- 661-07303, 16GB, DDR4, 2400

11. Fan

- 923-01679

12. Speaker, Pair, Left and Right

- 923-01681

13. Flash Storage

- 661-07311, 32GB
- 661-07312, 128GB
- 661-07315, 256GB
- 661-07317, 512GB
- 661-07319, 1TB
- 661-07320, 2TB

14. Wireless Card

- 661-07505

Note: Regional wireless cards have the same part number, but include a language code prefix. For example, J661-07505 is for Japan.

- ID, Indonesia; KH, Korea; PA, Asia PAC; Z, European Telecommunications Standards Institute (ETSI); ZM, Rest of World

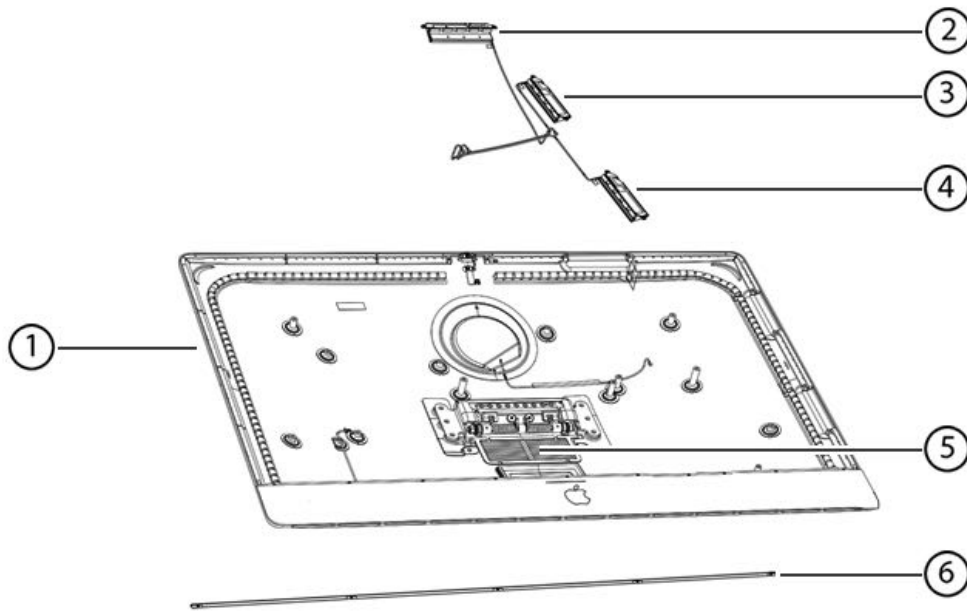
15. Logic Board

- 661-03378, 3.4GHz, 4GB
- 661-03379, 3.5GHz, 4GB
- 661-03382, 3.8GHz, 8GB
- 661-03383, 4.2GHz, 4GB
- 661-03384, 4.2GHz, 8GB

Not shown:

- **Kit, Thermal Pad, Wireless Card**, 076-1445
- **Wireless Support Card Tool**, 923-01807

Exploded View 2



1. Rear Housing

- 923-01666
- 923-01667, VESA

2. Bluetooth Antenna

- 923-00665

3. Middle Wi-Fi Antenna

- 923-00667

4. Lower Wi-Fi Antenna

- 9223-00668

5. RAM Door

- 923-01736

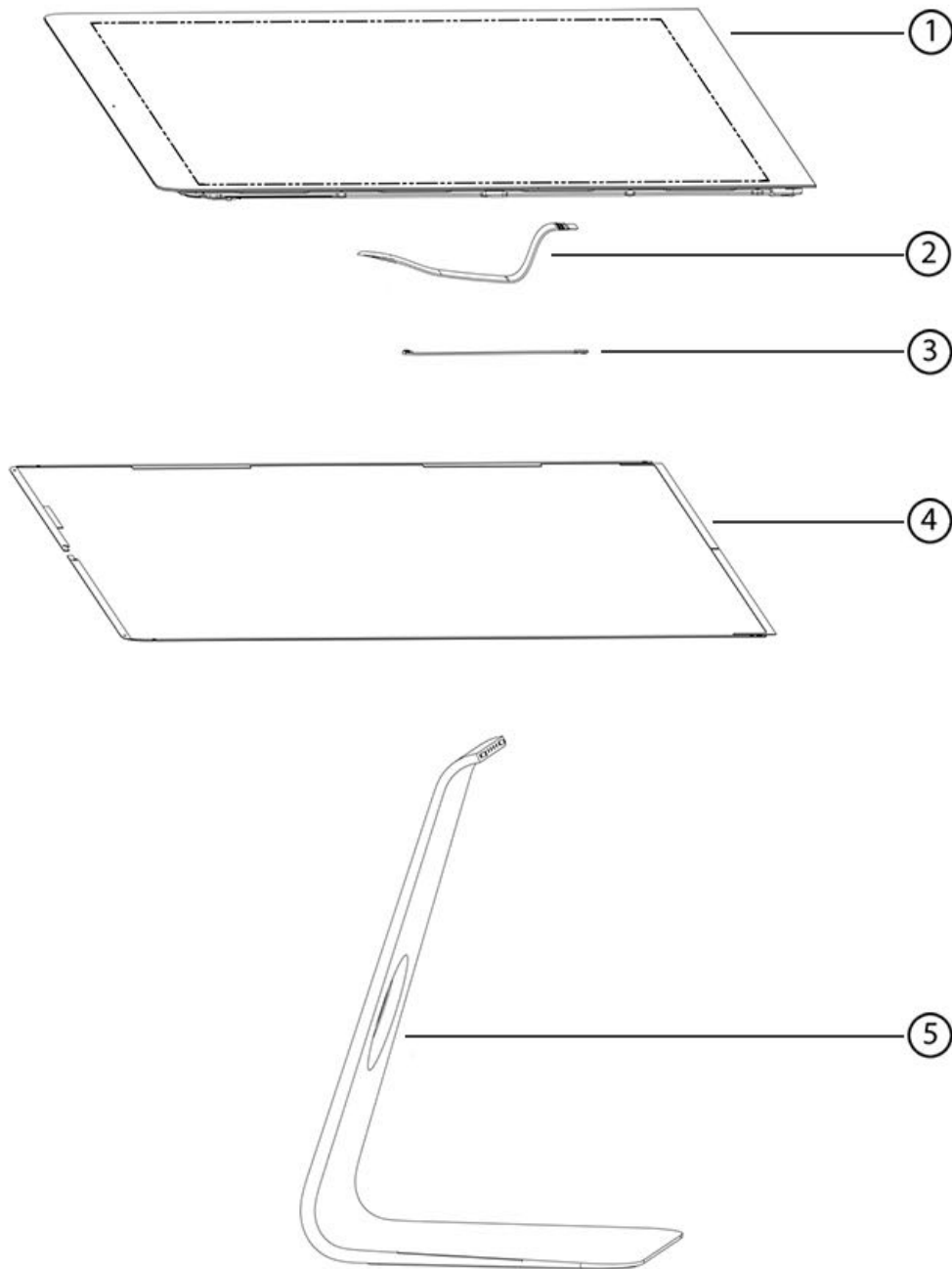
6. Chin Strap

- 923-01671

Not shown:

- **VESA Mechanism Plate**, 923-00657
- **VESA Tongue**, 923-01665
- **Latch, RAM Door**, 923-01735

Exploded View 3



1. Display Panel, LCD

- 661-07323

2. Cable, Embedded DisplayPort (eDP)

- 923-01668

3. Cable, Thermal Sensor, Display

- 923-0310

4. Very High Bond (VHB) Adhesive Strips

- See article [TP818: Required Tools](#).
- 076-00330, LCD Starter Kit
- 076-00332, Refill Kit

5. Stand

- 923-01664

Note: Some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery is no longer available to order via GSX. When the Mac repair process indicates the coin battery needs to be replaced, please order it from an electronics parts distributor.













Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.





Screw Chart

Screw Chart for iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)

Note: Screws are not to scale.

923-0328 T8  Flash storage (1)	923-0336 (Late 2015) T8  Flash storage (1)	923-0329 or 923-00529 T8  Stand (9)
923-0331 T8, 7.05 mm  Logic board (5) Power supply (2) Hard drive bracket (4)	923-0332 or 923-00669 T10  Fan (3)	923-0333 T10  Right speaker (2) Left speaker (2)
923-0334 T10  Mechanism (6)	923-0338 Phillips #00  Chin strap: <ul style="list-style-type: none"> • Late 2012 (5-hole) • Late 2013, Late 2014, Mid 2015, Late 2015 (9-hole) 	923-0304 T4  Bluetooth antenna (2) Middle Wi-Fi antenna (2) Lower Wi-Fi antenna (2)

<p>923-0396 T8, 23 mm</p>  <p>Power supply (2) Logic board (3)</p>	<p>923-0339 T5</p>  <p>Camera (2)</p>	<p>923-0394 923-01677 (2017) T5</p>  <p>Wireless card (2)</p>
<p>923-00609 (Late 2015) T5</p>  <p>Wireless antenna brackets (2)</p>	<p>923-00670 (Late 2015) T4</p>  <p>Wireless card (2)</p>	<p>923-0395 T10</p>  <p>Heat sink (1)</p>
<p>923-0377 T8, 8.13 mm</p>  <p>Hard drive (4)</p>	<p>923-00767 (Late 2015) T8, 17.80 mm</p>  <p>Logic board to rear housing (1)</p>	<p>923-0404 T5</p>  <p>RAM access door latch (4)</p>
<p>923-0418 Pentalobe</p>  <p>VESA (2)</p>	<p>923-0373 T25, 20.81mm (5-hole chin)</p> <p>Note: iMac Late 2012–Late 2013 Use only with rear housings 923-0378, 923-0426 (VESA).</p>  <p>Hard drive standoff (1)</p>	<p>923-0399 T25, 13.84 mm (5-hole chin)</p> <p>Note: iMac Late 2012–Late 2013 Use only with rear housings 923-0378, 923-0426 (VESA).</p>  <p>Power supply standoff (1)</p>

<p>923-0520 T25, 20.81 mm (9-hole chin)</p> <p>Note: iMac Late 2014, Mid 2015, Late 2015 Use with rear housings 923-0522, 923-00081. iMac 2017 use 923-01666.</p>  <p>Power supply standoff (1)</p>	<p>923-0521 T25, 20.81 mm (9-hole chin)</p> <p>Note: iMac Late 2012–Late 2015: Use only with rear housing 923-0522.</p>  <p>Hard drive standoff (1)</p>	<p>923-0570 T25</p>  <p>Hard drive standoff (1)</p>
<p>923-01675 (2017) T25, 20.81 mm</p> <p>Note: iMac 2017: Use with rear housing 923-01667.</p>  <p>Hard drive standoff (1)</p>		

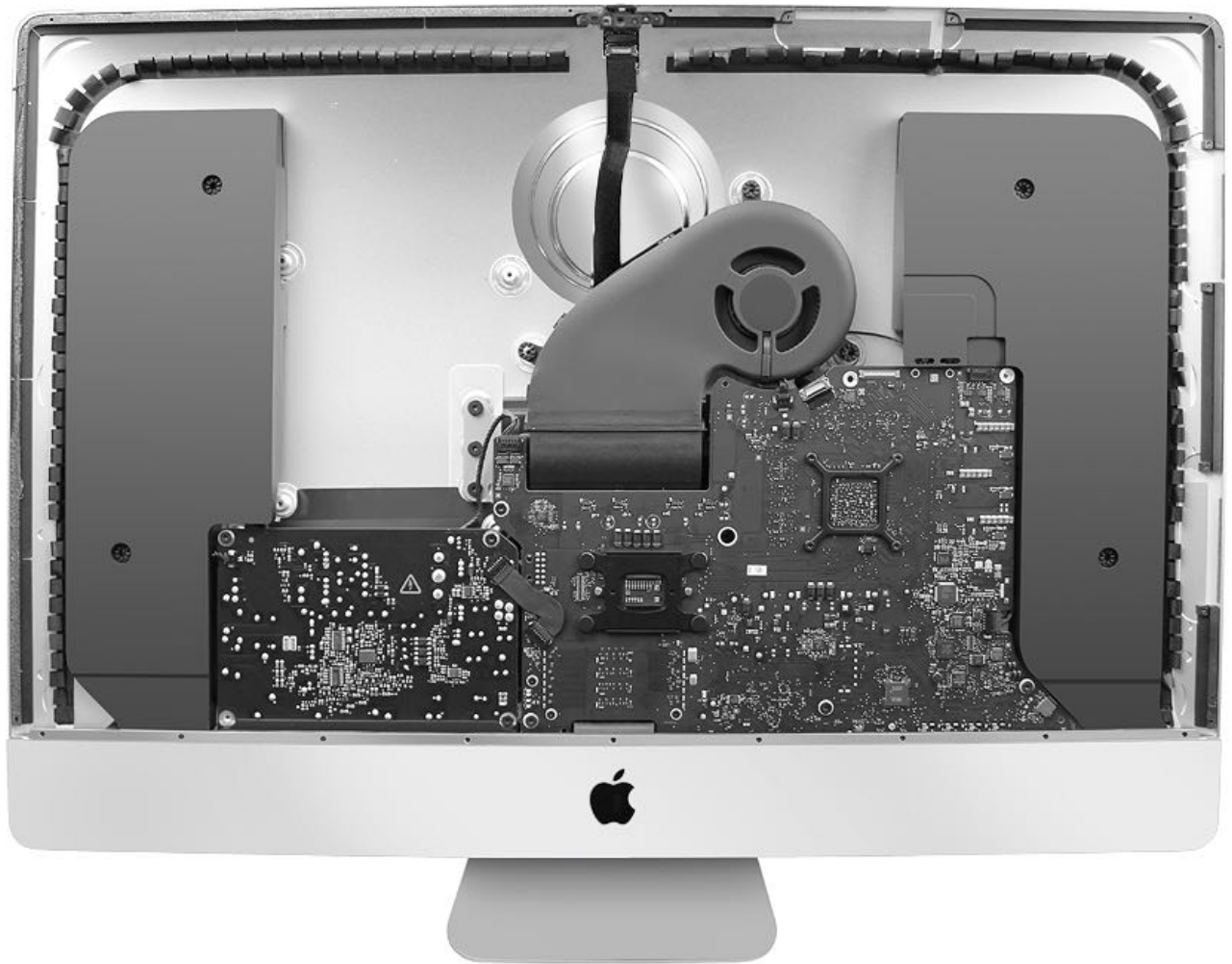
Internal Views

Internal Views of iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)

iMac (27-inch, Late 2012)



iMac (27-inch, Late 2013): Flash Storage Configuration, No Hard Drive

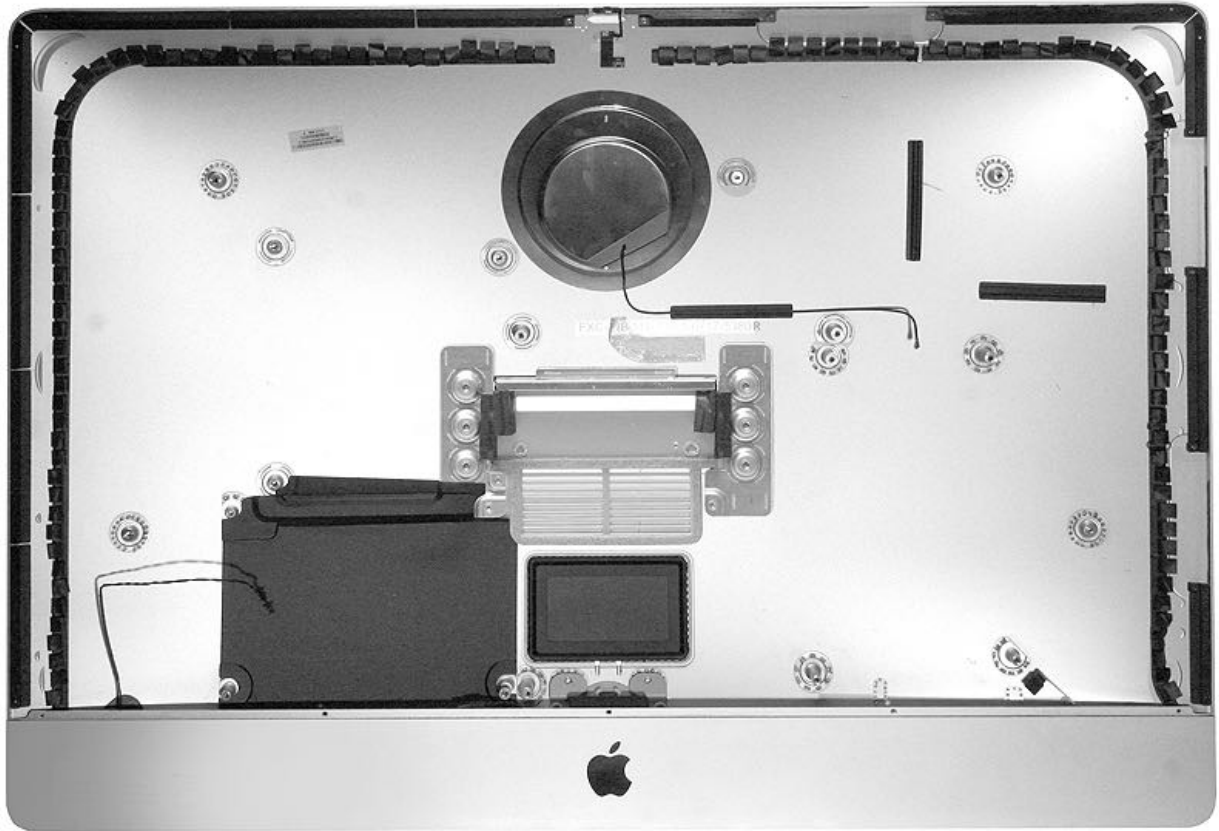


iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



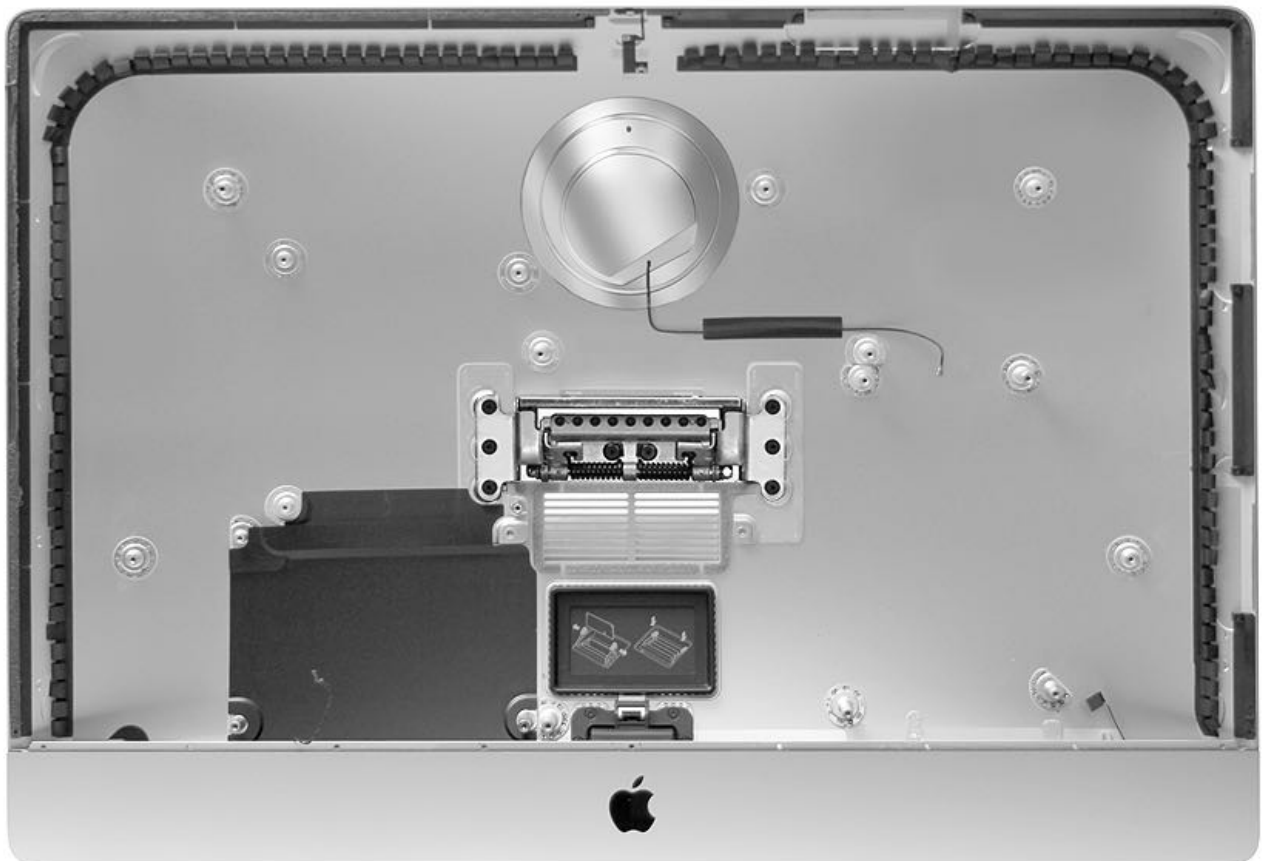
iMac (27-inch, Late 2012) Rear Housing (5 holes on chin)

Note: This part has been replaced by the 9-hole rear housing.

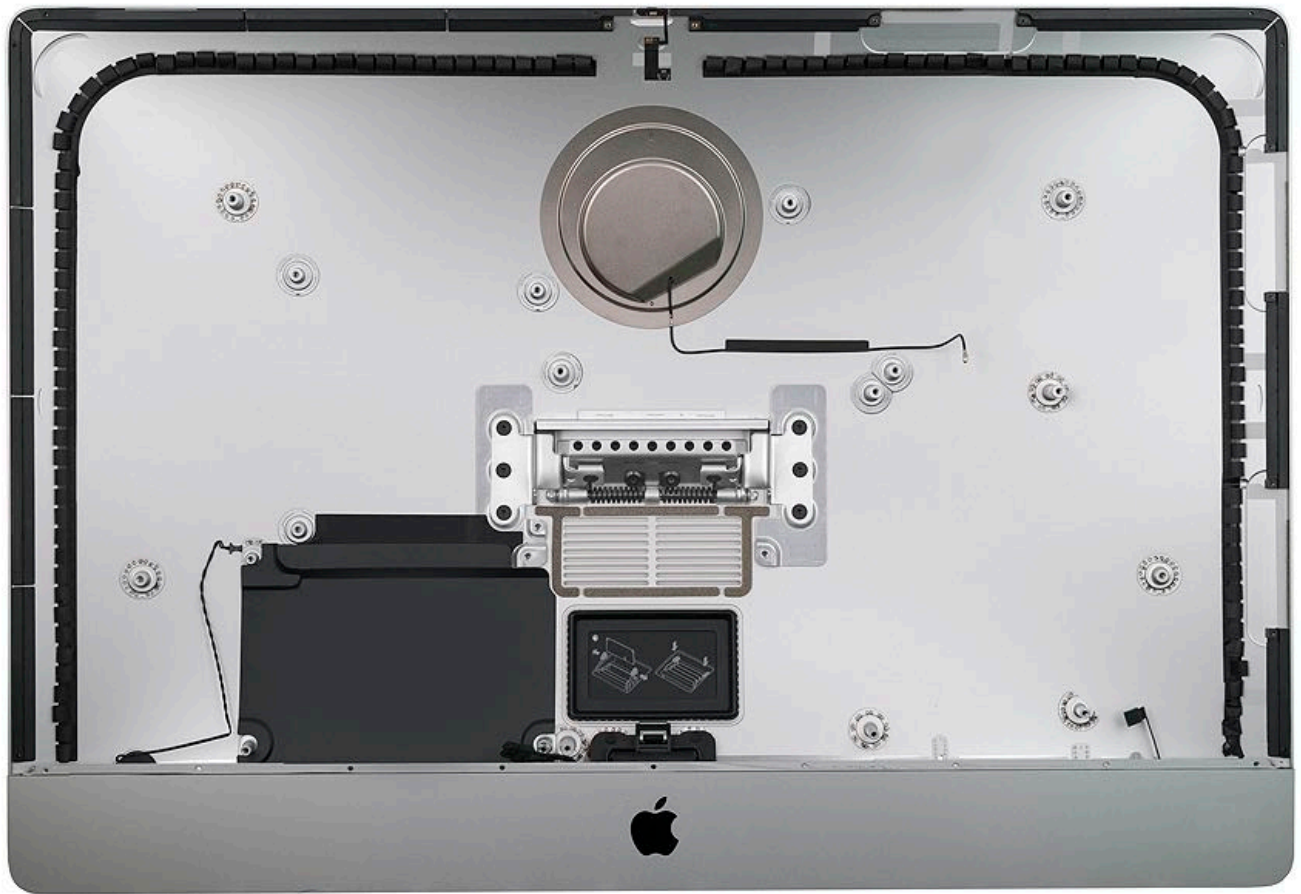


iMac (27-inch, Late 2013) Rear Housing (9 holes on chin)

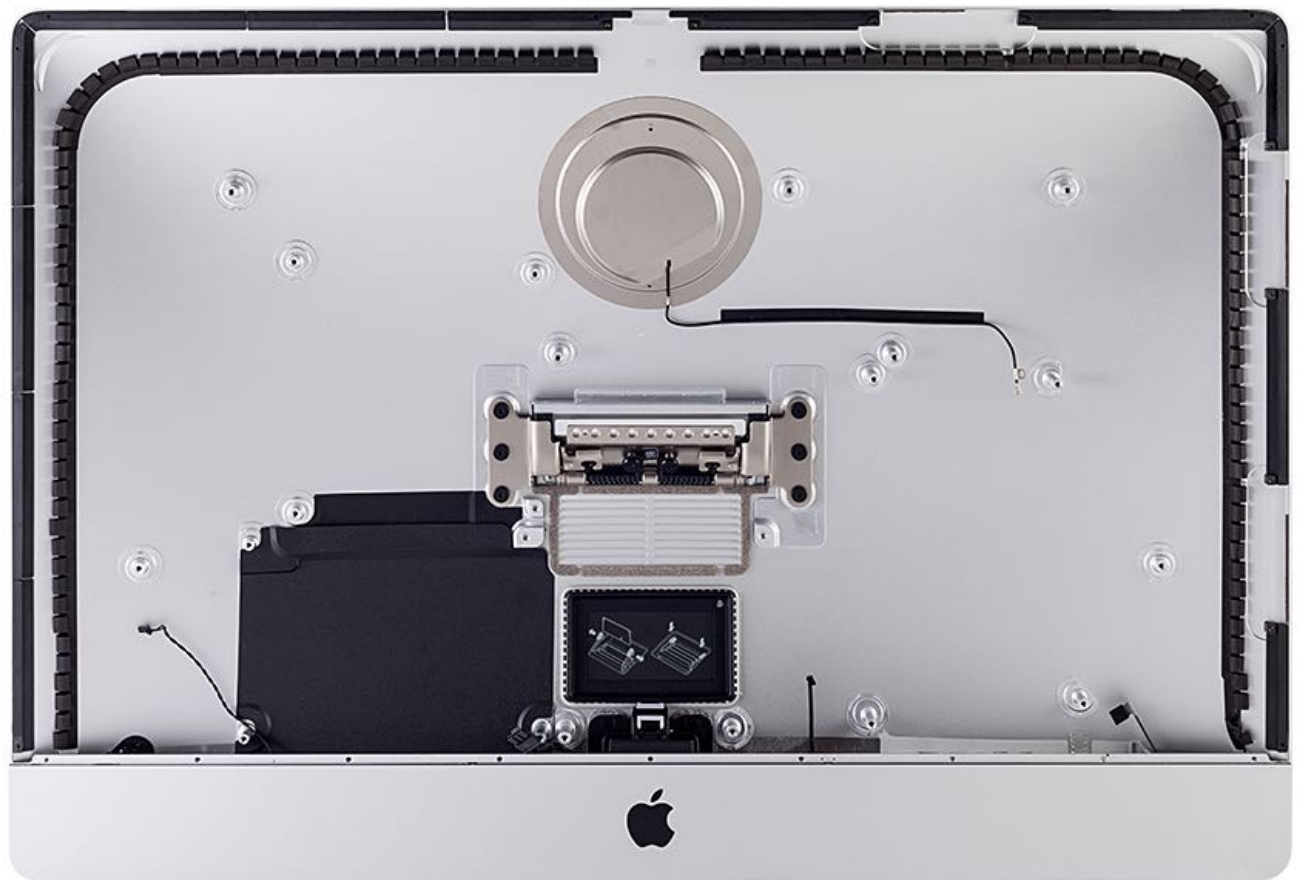
Note: The 9-hole chin strap is included with the rear housing.



iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015) Rear Housing (9 holes on chin)



iMac (Retina 5K, 27-inch, 2017) Rear Housing (9 holes on chin)



External Views

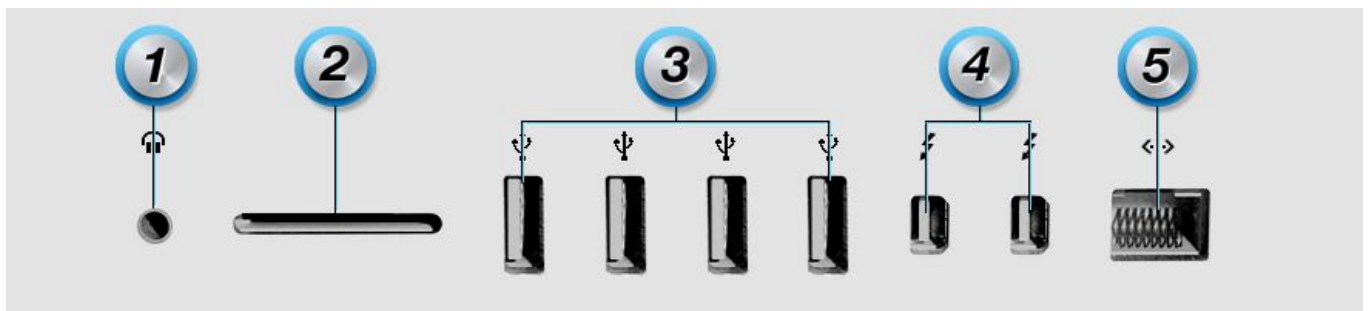
Front and Side Views of iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)



Rear View and Ports of iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015)

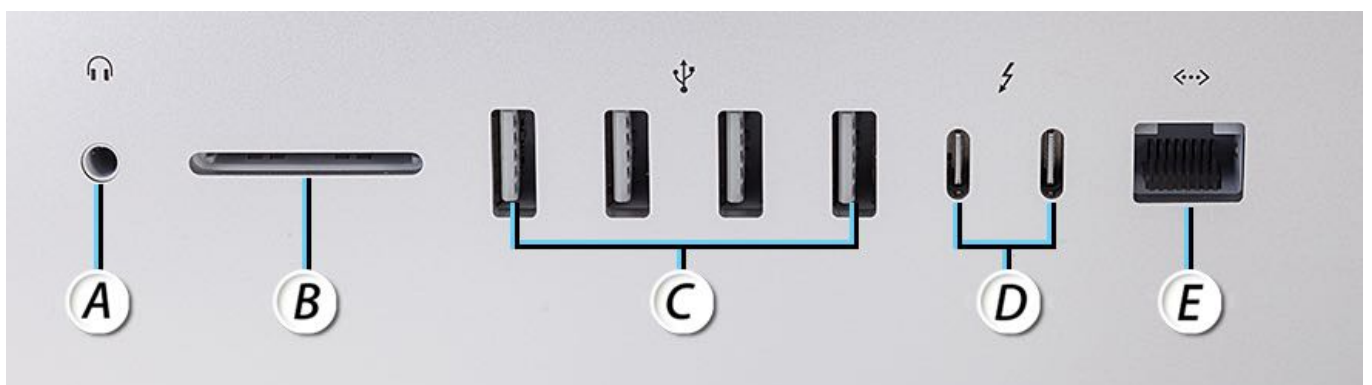


Ports on iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, and Late 2015)



1. Headphone jack
2. SDXC card slot
3. Four USB 3 ports (compatible with USB 2)
4. Two Thunderbolt (Late 2012 and Late 2013) or Thunderbolt 2 (Late 2014, Mid 2015, and Late 2015) ports
5. Ethernet (RJ-45 connector)

Ports on iMac (Retina 5K, 27-inch, 2017)



- A. Headphone jack
- B. SDXC card slot
- C. Four USB 3 ports (compatible with USB 2)
- D. Two Thunderbolt USB-C ports
- E. Ethernet (RJ-45 connector)

Power Button



RAM Access Door



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